Service Manual

Valleylab™

Argon Gas Delivery Unit II

1012506

Preface

This manual and the equipment it describes are for use only by qualified medical professionals trained in the particular technique and surgical procedure to be performed. It is intended as a guide for servicing the Force FX Electrosurgical Generator C only. Additional users information is available in the *Valleylab Argon Gas Delivery Unit II User's Guide*.

Equipment covered in this manual:
Valleylab Argon Gas Delivery Unit II (Force Argon II-20)
120 VAC nominal, 50–60 Hz

The *Valleylab Argon Gas Delivery Unit II Service Manual* consists of two parts: the text (part 1 of 2) and a *Schematics Supplement* (part 2 of 2) which contains the schematics.

Conventions Used in this Guide

Warning
Indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.

Caution
Indicates a hazardous situation, which if not avoided, may result in minor or moderate injury.

Notice
Indicates a hazard which may result in product damage.

Important
Indicates an operating tip or maintenance suggestion.

Limited Warranty

Covidien warrants each covered product listed below to be free from defects in material and workmanship for normal use and service for the period(s) set forth below. Covidien's obligation under this warranty is limited to the repair or replacement, at its sole option, of any product, or part thereof, which has been returned to it (or its authorized distributor) within the applicable time period shown below after delivery of the product to the original purchaser, and which examination discloses, to Covidien's satisfaction, that the product is defective. This limited warranty does not apply to any product, or part thereof, which has been repaired or altered in a way so as, in Covidien's judgment, to affect its stability or reliability, or which has been subjected to misuse, neglect, or accident.

The warranty periods for Covidien products are as follows:

ForceTriad™ Energy Platform	One year from date of shipment
Electrosurgical Generators	One year from date of shipment
Cool-tip™ RFA Generator	One year from date of shipment
Evident™ MWA Generator	One year from date of shipment
RFG-3C™ Plus Lesion Generator	One year from date of shipment
LigaSure™ Vessel Sealing System	One year from date of shipment
LigaSure™ Reusable Instruments	One year from date of shipment
Mounting Fixtures (all models)	One year from date of shipment
Footswitches (all models)	One year from date of shipment
Valleylab™ Argon Gas Delivery Unit II	One year from date of shipment
RapidVac™ Smoke Evacuator	One year from date of shipment
LigaSure™ Sterile Single Use Items	Sterility only as stated on packaging
Cool-tip™ Sterile Single Use Items	Sterility only as stated on packaging
Sterile Single Use Items	Sterility only as stated on packaging
Patient Return Electrodes	Shelf life only as stated on packaging

Notwithstanding any other provision herein or in any other document or communication, Covidien's liability with respect to this limited warranty and the products sold hereunder shall be limited to the aggregate purchase price for the products sold to the customer. This limited warranty is non-transferable and runs only to the original purchaser of the

covered product(s). There are no warranties which extend beyond the terms hereof. Covidien disclaims any liability hereunder or elsewhere in connection with the sale of products and for any form of indirect, tort, or consequential damages.

This limited warranty and the rights and obligations hereunder shall be construed under and governed by the laws of the State of Colorado, USA. The sole forum for resolving disputes arising under or relating in any way to this limited warranty is the District Court of the County of Boulder, State of Colorado, USA.

Covidien reserves the right to make changes in covered products built or sold by it at any time without incurring any obligation to make the same or similar changes to equipment previously built or sold by it.

THE OBLICATION TO REPAIR OR REPLACE A DEFECTIVE OR NONPERFORMING PRODUCT IS THE SOLE REMEDY OF THE CUSTOMER UNDER THIS LIMITED WARRANTY. **EXCEPT AS EXPRESSLY PROVIDED HEREIN, COVIDIEN DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO PRODUCTS, INCLUDING WITHOUT LIMITATION ALL IMPLIED WARRANTIES, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

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Chapter 1

Introduction

This manual provides instructions for servicing the Valleylab Argon Gas Delivery Unit II. This chapter introduces the features and components of the unit and reviews the precautions associated with repair.

General Description

The Valleylab Argon Gas Delivery Unit II System is designed to provide a controlled flow of argon (an inert, nonreactive gas) over the active electrode of an electrosurgical accessory which is powered by a Force series electrosurgical generator. A variety of handsets provide argon-enhanced electrosurgery as well as standard electrosurgery.

Argon-enhanced coag permits the coagulation of certain tissue in a more controlled manner than with standard electrosurgical coagulation.

In argon-enhanced coag, activating the handset creates an argon gas plasma between the electrode and the tissue. The presence of inert gas at the surgical site inhibits combustion with other gases (e.g., oxygen, nitrogen, etc.) and pushes residual smoke, water vapor, or fluids away from the surgical site, thereby improving visibility.

The Valleylab Argon Gas Delivery Unit II has an overpressure system that continuously measures peritoneal cavity pressure in real-time. This system operates when the unit is in the low flow range for argon gas (0.5 - 4 LPM), i.e. the gas flow range for laparoscopic procedures. Use the overpressure system in conjunction with a carbon dioxide insufflator monitor.

The overpressure system senses when the peritoneal cavity pressure meets or exceeds the user selectable setpoint (between 5 and 30 mm Hg). As the peritoneal cavity pressure approaches the setpoint, the **Overpressure** indicator on the front panel illuminates, and an intermittent alarm sounds. When the peritoneal cavity pressure meets or exceeds the setpoint, the **Overpressure** indicator on the front panel illuminates, and a continuous alarm sounds.

List of Components

The Valleylab Argon Gas Delivery Unit II is shipped with the following components:

- Valleylab Argon Gas Delivery Unit II
- ESU Interface Cable
- E0502-12 Active Adapter
- Argon Gas Tank Regulator Assembly for Tank 1
- Power Cord
- Power cord retaining clip
- User's Guide, Service Manual, Reference Card

Service Personnel Safety

Before servicing the Valleylab Argon Gas Delivery Unit II, it is important that you read, understand, and follow the instructions supplied with the unit and with any other equipment used to install, test, adjust, or repair the unit.

General Service Precautions

Caution

The unit contains electrostatic sensitive components. When repairing the unit, work at a static control workstation. Wear a grounding strap when handling electrostatic sensitive components. Handle the circuit boards by their nonconductive edges. Use an antistatic container for transport of electrostatic sensitive components and circuit boards.

Notice

Connect the power cord to a wall receptacle having the correct voltage. Otherwise, product damage may result.

If required by local codes, connect the unit to the hospital equalization connector with an equipotential cable.

Fire/Explosion

Warning

Do not install the Valleylab Argon Gas Delivery Unit II System in the presence of flammable anesthetics, gases, liquids, or objects.

Always use high purity grade (99.998% pure or better) argon gas. Do not use oxygen for any adjustments. Oxygen regulation values differ from argon regulation values, and incorrect adjustments result.

For continued protection against fire hazard, replace fuses only with those having the same type and rating as the original fuse.

Fire Hazard Do not place active accessories near or in contact with flammable materials (such as gauze or surgical drapes). Electrosurgical accessories that are activated or hot from use can cause a fire. Use a holster to hold electrosurgical accessories safely away from personnel and flammable materials.

Electric Shock

Warning

Disconnect the power cord before replacing parts.

Always unplug the Valleylab Argon Gas Delivery Unit II before cleaning.

Do not connect a wet power cord assembly to the unit or a wall receptacle.

Ensure that all accessories and adapters are correctly connected and that no metal is exposed.

The interface cable must be connected to the Valleylab Argon Gas Delivery Unit II and the electrosurgical generator for operation. If the Valleylab Argon Gas Delivery Unit II is not being used, disconnect the power cord from the wall receptacle.

Do not touch any exposed wiring or conductive surface while the unit is disassembled and energized. Never wear a grounding strap when working on an energized unit. Otherwise, damage to circuit board components may result.

Take appropriate precautions (such as use of isolated tools and equipment; use of the "one hand rule," etc.) when taking measurements or troubleshooting the unit.

The front heatsink on the power supply is at an elevated voltage. Do not come in contact with it. Do not use it for ground. Otherwise, burns to service personnel may result. Damage to circuit board components may result.

Caution

When attaching the Argon Handset, ensure that the RF jumper cable is disconnected from the RF Input receptacle on the Valleylab Argon Gas Delivery Unit II front panel.

High Pressure

Warning

Ensure that argon gas tanks and fittings used with the Valleylab Argon Gas Delivery Unit II have been pressure tested, certified, and filled according to applicable standards and local codes. In filling the tanks, ensure your supplier meets all local and national codes. Do not over pressurize the tanks. Do not exceed 3,000 psig.

Use only the high pressure regulator supplied with the Valleylab Argon Gas Delivery Unit II. Order replacement regulators from Valleylab. Argon gas pressure should not exceed 434 KPa (63 psig) ± 5% at the regulator hose connection to the receptacle on the rear panel.

Always ensure that the regulator tank fitting is properly connected to the tank valve outlet.

Caution

Improperly secured gas tanks and/or improper connection of gas lines may result in injury.

Argon Gas

Warning

Use only high purity grade (99.998% pure or better) argon gas. Patient safety may be compromised by using low purity gas.

The regulator coupling in this unit is compatible with many common gas tanks (e.g., Freon, helium, krypton, neon, nitrogen, and xenon). Only connect argon gas to the Valleylab Argon Gas Delivery Unit II. Using other gases may affect gas flow, create phosgene or other harmful gases, or create an explosion hazard.

Cleaning

Notice

Do not clean the unit with abrasive cleaning or disinfectant compounds, solvents, or other materials that could scratch the panels or damage the generator.

Chapter 2

Controls, Indicators, and Receptacles

The controls, indicators and receptacles for accessories are located on the front and rear panels of the Valleylab Argon Gas Delivery Unit II. This chapter describes each component of the unit and its function.

Detailed specifications for the unit are in Chapter 3, *Technical Specifications*.

Valleylab Argon Gas Delivery Unit II Front Panel Descriptions

Overpressure System

This system operates only when the Valleylab Argon Gas Delivery Unit II System is in the low gas flow range. Use only this range for laparoscopic procedures.

Overpressure Setpoint Display - The display shows the overpressure setpoint (available only when using the low flow range).

Overpressure Indicator - As the peritoneal cavity pressure approaches the overpressure setpoint, this indicator illuminates and an intermittent alarm sounds. When the peritoneal cavity pressure meets or exceeds the setpoint, this indicator remains illuminated and a continuous alarm sounds.

Peritoneal Pressure Display - The display indicates the peritoneal cavity pressure (available only when using the low flow range). The display flashes when the pressure is below 1 mm Hg.

Overpressure On/Off Switch - Press this button to turn peritoneal cavity pressure monitoring on or off (available only when using the low flow range).

Overpressure Control Knob - To increase (+) the alarm setting, turn the knob clockwise. To decrease (-) the alarm setting, turn the knob counterclockwise.

Setpoint Symbol

System Purge Control

Handset Tubing or Peritoneal Pressure Tubing Obstruction Indicator - When a gas tubing obstruction occurs, the indicator illuminates and an alarm sounds. The Gas Flow indicator or the Overpressure indicator will also be flashing.

Gas Line Purge Button - Pressing this button removes air and causes a brief discharge of argon gas through the handset tubing at a gas flow of 3.0 LPM.

Gas Flow Controls

Gas On/Gas Off Button - Press this button to select gas on or gas off.

Gas On Indicator - When you turn on the gas, the indicator illuminates and gas is available to the handset.

Gas Off Indicator - When you turn off the gas, the indicator illuminates and gas is not available to the handset.

Gas Flow Indicator - This indicator illuminates when you activate argon-enhanced coag or argon-shrouded cut or when you press the Gas Line Purge button.

Flow Rate Display - The display shows gas flow on a scale from 0.5 to 12 LPM. The

default gas flow setting is 0.5 LPM.

Standard Gas Flow Indicator - This green LED illuminates when you select the standard gas flow range.

Gas Flow Range Selector - Press this switch to the top position for standard flow range (0.5 - 12 LPM) or bottom position for low gas flow (0.5 - 4 LPM).

Low Gas Flow Indicator - This green LED illuminates when you select the low gas flow range.

Flow Control Knob - To increase (+) the argon gas flow, turn the knob clockwise. To decrease (-) the argon gas flow, turn the knob counterclockwise.

Gas Tank Indicators and Controls

Tank Select Button, Tank 1 - Press this button to select tank 1.

Tank Indicator, Tank 1 - The indicator illuminates when you select tank 1.

Low Pressure Alarm, Tank 1 - The indicator illuminates when the tank pressure is below 10% of full tank pressure. The indicator flashes and a brief alarm sounds when all available tanks are low.

% Argon in Tank 1 - The bar graph indicates percent of argon gas remaining in tank 1.

Tank Select Button, Tank 2 - Press this button to select tank 2.

Tank Indicator, Tank 2 - The indicator illuminates when you select tank 2.

Low Pressure Alarm, Tank 2 - The indicator illuminates when the tank pressure is below 10% of full tank pressure. The indicator flashes and a brief alarm sounds when all available tanks are low.

% Argon in Tank 2 - The bar graph indicates percent of argon gas remaining in tank 2.

Gas Lines and Receptacles

On/Off Switch - This switch supplies power to the unit.

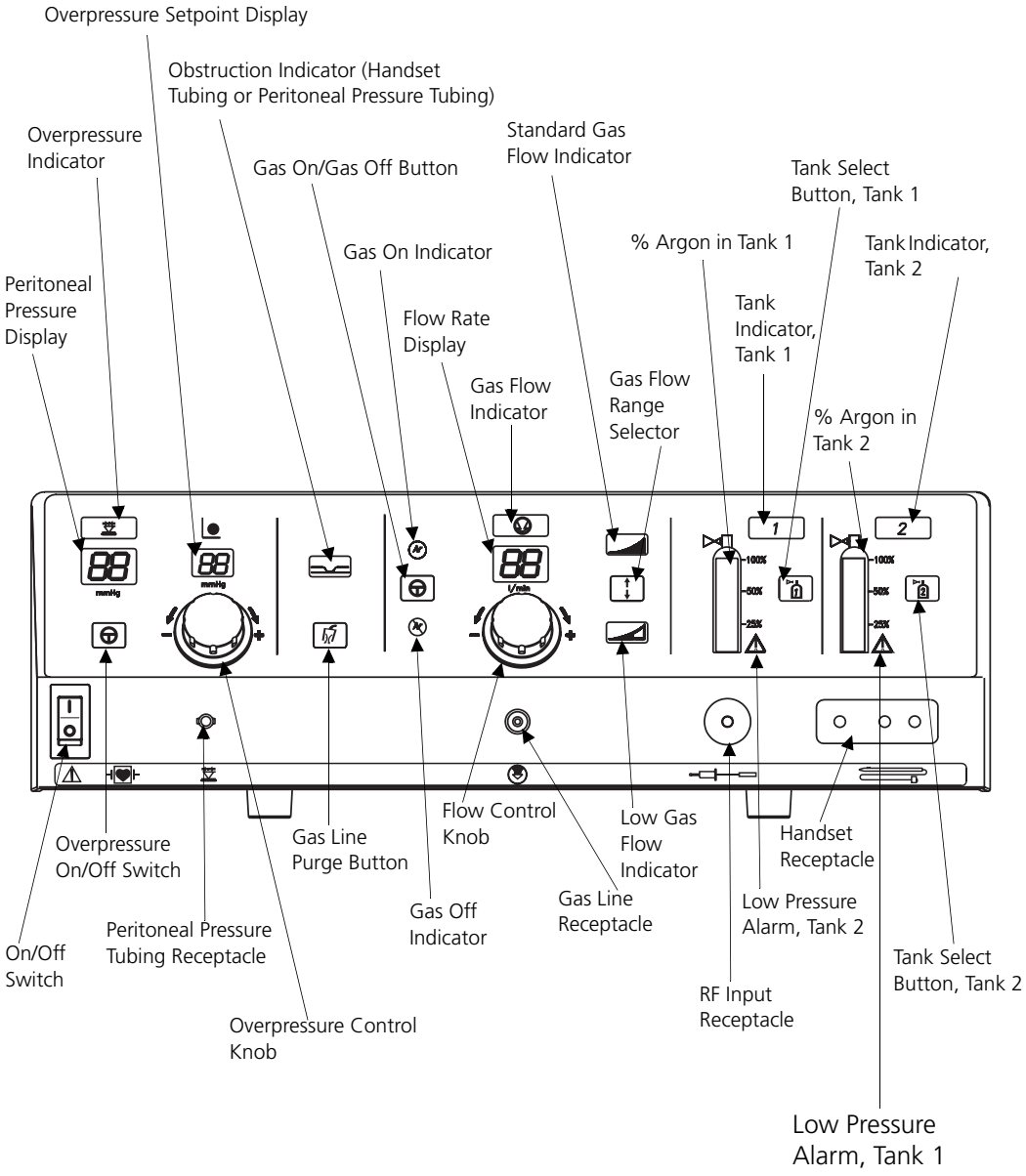
Peritoneal Pressure Tubing Receptacle - Connect the peritoneal pressure tubing filter to this luer receptacle.

Gas Line Receptacle - Connect the handset particle filter to this luer receptacle.

RF Input Receptacle - Connect the RF jumper cable to this receptacle when using the Valleylab Argon Accessory.

Handset Receptacle - Connect the handset three-pin connector to this receptacle.

Front panel


Overpressure Setpoint Display
Obstruction Indicator (Handset Tubing or Peritoneal Pressure Tubing)
Overpressure Indicator
Gas On/Gas Off Button
Standard Gas Flow Indicator
Tank Select Button, Tank 1
Gas On Indicator
% Argon in Tank 1
Tank Indicator, Tank 2
Peritoneal Pressure Display
Flow Rate Display
Tank Indicator, Tank 1
Gas Flow Indicator
Gas Flow Range Selector
% Argon in Tank 2
Flow Control Knob
Low Gas Flow Indicator
Handset Receptacle
Overpressure On/Off Switch
Gas Line Purge Button
Gas Off Indicator
Gas Line Receptacle
Low Pressure Alarm, Tank 2
On/Off Switch
Peritoneal Pressure Tubing Receptacle
Tank Select Button, Tank 2
RF Input Receptacle
Overpressure Control Knob
Low Pressure Alarm, Tank 1

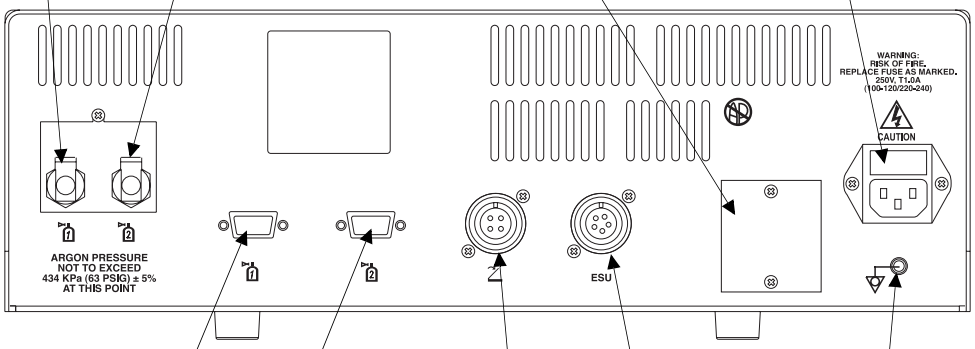
Rear panel

Tank 1 Receptacle
Connect the tank 1 regulator hose to this receptacle.

RS-232 Serial Port
The Valleylab Argon Gas Delivery Unit II may be adjusted through this serial port to stop argon gas delivery when the peritoneal cavity pressure meets or exceeds the selected setpoint. Contact your Valleylab representative for further information.

Power Entry Module
Connect a power cord with a three-prong hospital grade connector to this receptacle. There are two entry module fuses in this receptacle.

Tank 2 Receptacle
Connect the tank 2 regulator hose to this receptacle.



Equipotential Grounding Lug
Use an equipotential grounding cable to connect the generator to protective earth ground.

Tank 2 Transducer Receptacle
Connect the tank 2 transducer cable to this receptacle.

Tank 1 Transducer Receptacle
Connect the tank 1 transducer cable to this receptacle.

ESU Interface Cable Receptacle
Connect a Valleylab electrosurgical generator to this receptacle using the ESU interface cable provided by Valleylab.

Footswitch Receptacle
Connect a Valleylab electrosurgical footswitch to this receptacle. Use only a Valleylab footswitch with the Valleylab Argon Gas Delivery Unit II. Use of an incompatible footswitch may case unexpected output. Do not plug the footswitch into the electrosurgical generator.

Chapter 3

Technical Specifications

Specifications subject to change without notice.

Performance Characteristics

Standard Conditions of Measurement

Unless otherwise specified, all measurements are specified at an ambient temperature of 70° F (21° C) and 760 torr.

Operating Parameters

Temperature Range: 50° F – 104° F (10° C – 40° C)

Humidity Range: 15% – 85%, noncondensing

Atmospheric Pressure: 10 psia - 15.4 psia (70 KPa – 106 KPa)

Storage and Shipping

Temperature Range: -40° F – 158° F (-40° C – 70° C)

Humidity Range: 10% – 85%, noncondensing

Atmospheric Pressure: 10 psia - 15.4 psia (70 KPa – 106 KPa)

Input Power Source

Operating Range: 100V – 120 V ~

Line frequency: 50 Hz – 60 Hz

Current: 0.5 ampere

Power consumption: 100 VA – 120 VA

Low Frequency Leakage (50Hz – 60 Hz)

All patient connected terminals tied together:

Source current normal polarity, intact chassis ground< 10 µA

Source current normal polarity, ground open< 50 µA

Source current reverse polarity, ground open< 50 µA

Sink current, all inputs < 20 µA

Gas Flow Ranges

Low Gas Flow: 0.5 - 4 standard liters/minute ± 15% of the flow rate shown on the Flow display.

Standard Gas Flow: 0.5 - 12 standard liters/minute ± 15% of the flow rate shown on the Flow display.

Audio Volume

The alarm tones are set to a level of > 65 dBA at 1 m and are not adjustable.

Approximate Weight

24 lb. (10.9 kg)

Size

17.8 in. x 16.0 in. x 5.6 in. (45.2 cm x 40.6 cm x 14.2 cm)

Gas Tanks

Maximum Pressure: 2000 psi (13790 kPa) (138 bar)

Power Cord Specification

This unit was equipped from the factory with a 110 NEMA 5-15 power cord. Should the AC power cord need to be replaced to match another plug configuration, the replacement plug/cable/receptacle configuration must meet or exceed the following specifications:

100 - 120 VAC

Cable - SJT16/3, IEC color code, maximum length 15 ft. (5 m)
Plug - minimum 10 A - 125 VAC
Unit receptacle - IEC female, minimum 10 A - 125 VAC

Standards and IEC Classifications

The Valleylab Argon Gas Delivery Unit II meets all pertinent clauses of the IEC 60601-1 second edition and IEC 60601-2-2 third edition.

ATTENTION: Consult accompanying documents.

Danger: Explosion risk if used with flammable anesthetics.

To reduce the risk of electrical shock, do not remove the cover. Refer servicing to qualified service personnel.

UL 60601-1
CAN/CSA C22.2 NO. 601.1
47AK
E199592

Classified with respect to electrical shock, fire, mechanical, and other specified hazards only in accordance with UL60601-1 and CAN/CSA C22.2 No. 601.1.

Type CF Equipment (IEC 60601-1) /Defibrillator Proof

The Valleylab Argon Gas Delivery Unit II unit provides a high degree of protection against electric shock, particularly regarding allowable leakage currents. It is type CF isolated (floating) output and may be used for procedures involving the heart.

This generator complies with the ANSI/AAMI HF18 specifications for "defibrillator proof" designation and IEC 60601-2-2.

Liquid Spillage (IEC 60601-2-2 Clause 44.3)

The Valleylab Argon Gas Delivery Unit II is constructed so that liquid spillage in normal use des not wet electrical insulation or other components which when wetted are likely to adversely affect the safety of the equipment.

EMC Compatibility

Electromagnetic Compatibility (IEC 60601-1-2 and IEC 60601-2-2)

The Valleylab Argon Gas Delivery Unit II unit complies with the appropriate IEC 60601-1-2 and IEC 60601-2-2 specifications regarding electromagnetic compatibility.

Notice

The Valleylab Argon Gas Delivery Unit II should not be used adjacent to or stacked with operating room equipment, unless otherwise specified in the *Valleylab Argon Gas Delivery Unit II User's Guide* and *Service Manual*. The Valleylab Argon Gas Delivery Unit II should be used only in the intended configuration.

The electrosurgical generator used with the Valleylab Argon Gas Delivery Unit II delivers RF energy during activation. Observe other electronic medical equipment during activation of the Valleylab Argon Gas Delivery Unit II for any possible adverse electromagnetic effects. Provide adequate separation of this equipment to minimize the risk of adverse effects.

The use of accessories, other than specified in the *Valleylab Argon Gas Delivery Unit II User's Guide* and *Service Manual*, may increase emissions or decrease immunity of the Valleylab Argon Gas Delivery Unit II.

Guidance and manufacturer's declaration - electromagnetic emissions		
The Valleylab Argon Gas Delivery Unit II is intended for use in the electromagnetic environment specified below. The customer or the user of the Valleylab Argon Gas Delivery Unit II should ensure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment - guidance**
RF emissions CISPR 11	Group 1	The Valleylab Argon Gas Delivery Unit II uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The Valleylab Argon Gas Delivery Unit II is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC61000-3-3	Complies	

Guidance and manufacturer's declaration - electromagnetic immunity			
The Valleylab Argon Gas Delivery Unit II is intended for use in the electromagnetic environment specified below. The customer or the user of the Valleylab Argon Gas Delivery Unit II should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	+/-6 kV contact +/-8 kV air	+/-6 kV contact +/-8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	+/-2 kV for power supply lines +/-1 kV for input/ output lines	+/-2 kV for power supply lines +/-1 kV for input/ output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	+/-1 kV differential mode +/-2 kV common mode	+/-1 kV differential mode +/-2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% Ut (>95% dip in Ut) for 0,5 cycle 40% Ut (>60% dip in Ut) for 5 cycles 70% Ut (>30% dip in Ut) for 25 cycles <5% Ut (>95% dip in Ut) for 5 sec	<5% Ut (>95% dip in Ut) for 0,5 cycle 40% Ut (>60% dip in Ut) for 5 cycles 70% Ut (>30% dip in Ut) for 25 cycles <5% Ut (>95% dip in Ut) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Valleylab Argon Gas Delivery Unit II requires continued operation during power mains interruptions, it is recommended that the Valleylab Argon Gas Delivery Unit II be powered from an uninterruptible power supply or a battery.
Power frequency (50/ 60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: Ut is the a.c. mains voltage prior to the application of the test level.			

Guidance and manufacturer's declaration - electromagnetic immunity			
The Valleylab Argon Gas Delivery Unit II is intended for use in the electromagnetic environment specified below. The customer or the user of the Valleylab Argon Gas Delivery Unit II should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment - guidance**
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150KHz to 80MHz 3 V/m 80MHz to 2.5GHz	3 V 7 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the Valleylab Argon Gas Delivery Unit II, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance** $d=1.2\sqrt{P}$ $d=0.5\sqrt{P}$ 80MHz to 800MHz $d=\sqrt{P}$ 800MHz to 2.5GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, should be less than the compliance level in each frequency range Interference may occur in the vicinity of equipment marked with the following symbol:
NOTE 1 At a 80MHz and 800MHz, the higher frequency range applies. **NOTE 2** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
a. Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Valleylab Argon Gas Delivery Unit II is used exceeds the applicable RF compliance level above, the Valleylab Argon Gas Delivery Unit II should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Valleylab Argon Gas Delivery Unit II. **b.** Over the frequency range 150kHz to 80MHz, field strengths should be less than 3V/m.			

Recommended separation distances between portable and mobile RF communication equipment and the Valleylab Argon Gas Delivery Unit II

The Valleylab Argon Gas Delivery Unit II is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The Customer or the user of the Valleylab Argon Gas Delivery Unit II can help prevent electromagnetic interferences by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Valleylab Argon Gas Delivery Unit II as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter (W)	**Separation distance according to frequency of transmitter (m)**		
	150 kHz to 80MHz $d=1.2\sqrt{P}$	**80MHz to 800MHz $d=0.5\sqrt{P}$**	**800MHz to 2.5GHz $d=\sqrt{P}$**
0.01	.12 m	0.05 m	0.1 m
0.1	.38 m	0.16 m	0.32 m
1	1.2 m	0.5 m	1 m
10	3.8 m	1.6 m	3.2 m
100	12 m	5 m	10 m

For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1 At a 80MHz and 800MHz, the separation distance for the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Chapter 4

Principles of Operation

This chapter provides the basic circuit theory for the Valleylab Argon Gas Delivery Unit II. A functional block diagram appears at the end of this chapter. Refer to the Schematics Supplement for schematics of the Control Board, Display Board, and Footswitch Board.

Functional Descriptive Overview

The electronics of the Valleylab Argon Gas Delivery Unit II perform a variety of functions:

- Direct interface signals from the Valleylab Argon Gas Delivery Unit II to the associated electrosurgical unit (ESU).
- Control argon gas delivery at digitally preset flow rates.
- Monitor error conditions: (gas line obstructions, low tank pressures for each tank, dosage error, power supply voltage, proper clock signals, software errors)
- A special error routine for line obstruction to exhaust the pressurized gas line.
- Automatic selection or switching of argon gas tank lines.
- Allows the surgeon to select argon enhanced or standard electrosurgery using the Valleylab Argon Handset.
- Allows the selection of low or standard gas flow.
- Allows the purging of the attached gas tubing.
- Allows control and monitoring of the argon gas tanks.
- Bar graphs display the % volume available in each argon gas tank.
- Has isolation electronics to prevent dielectric breakdown between the RF electrical signal and the electronics.
- Allows the unit to operate from 120 Vac – 240 Vac nominal, 50 Hz – 60 Hz.
- Provides safe shutdown in case of power failure.
- Monitors peritoneal cavity pressure in low flow mode.

Circuit Descriptions

Refer to the circuit descriptions in the Schematic Supplement for the designated sheet number of the schematic.

Main Microprocessor (Control Board, sheet 2 of 8)

An 80C31 single chip microprocessor (U40) controls the Valleylab Argon Gas Delivery Unit II. The microprocessor controls all the functions of the unit. It provides direct communication between the Control Board, front panel, rear panel, memory, and the malfunction microprocessor.

RS-232 Interface (Control Board, sheet 2 of 8)

The RS-232 interface (U5) allows service personnel to communicate with a Valleylab Argon Gas Delivery Unit II by a computer. This allows for troubleshooting of the unit.

Address Latches and I/O Decoders (Control Board, sheet 2 of 8)

The address latches (U33 and U49) and I/O decoders (U28 and U29) work with the main microprocessor to deliver to and receive information from the rest of the circuits.

Solenoid Drivers (Control Board, sheet 3 of 8)

The argon gas control system is a collection of five fixed orifices capable of producing gas flows of 0.5, 1.0, 2.0, 4.0, and 8.0 liters per minute (LPM) in parallel and individually selectable. The pneumatic portion of the Valleylab Argon Gas Delivery Unit II consists of one or two cylinders of compressed argon pressurized to a maximum of 2000 psig (not supplied), a high pressure transducer and regulator, HEPA filter, argon gas control valve with dual inlet tank selector valve and a delivery pressure relief valve. Argon passes from the gas tanks to the high pressure regulators where it acts on the high pressure transducers and leaves the regulators at a pressure of 60 psig. The gas then goes through a tank selector valve that controls which tank is to be used as the gas source. From the tank selector valve the gas travels through a HEPA filter, a second stage regulator, and the argon control valve.

The microprocessor causes solenoid drivers (U7, U10, U11, U16, U17, U23, and U24) to open the appropriate fixed-sized orifice(s) based on the argon flow rate selected on the Valleylab Argon Gas Delivery Unit II front panel. The front panel is a direct readout in LPM.

Audio Amplifier (Control Board, sheet 3 of 8)

An error or a change in setting on the front panel enables the audio annunciator (U4). The speaker is on the Footswitch Board.

Solenoid Master Power Switch (Control Board, sheet 3 of 8)

This circuit controls the power to the solenoid drivers and is under the control of the main microprocessor. The power to the solenoid drivers is terminated under fatal error conditions.

Watchdog Circuitry (Control Board, sheet 4 of 8)

A two stage reset circuit (U20) ensures that the microcontroller is held reset for a short time after AC power is applied. During this time, the remainder of the circuitry stabilizes before the microcontroller starts to exercise power.

Malfunction Microprocessor (Control Board, sheet 4 of 8)

The malfunction microprocessor (U12) checks for any errors caused and/or not reported by the microprocessor during operation. During initialization, the malfunction microprocessor (PIC) checks the main microprocessor and the circuitry for integrity. A major function of the PIC is to monitor the argon gas valve control system for dosage error. The dosage error circuit determines whether the delivered gas flow rate lies within specified limits or is out of range. When a dosage error is detected, the PIC immediately inhibits gas flow, sounds an alarm, and flashes an error code on the front panel. To clear the dosage error, turn off and then turn on the power to the unit.

To allow the Valleylab Argon Gas Delivery Unit II to enter the test mode, the PIC can be disabled. To disable the PIC, connect pins 1 and 2 to JP2. To return the unit to normal function, connect pins 2 and 3 to JP2.

Argon Gas Tank Pressure Scale (Control Board, sheet 4 of 8)

The % **Argon in Tank 1 and 2** displays on the front panel indicate the gas remaining in each tank. To properly display this information relative to the tank size, adjust the connections at JP1. For full scale display when using a 2000 psig tank, connect pins 2 and 3.

Display Interface and Lamp Drivers (Control Board, sheet 4 of 8)

The LEDs and lamps on the front panel indicate the mode of operation of the Valleylab Argon Gas Delivery Unit II. The keyboard and knobs allow the user to interface with the unit. A ribbon cable provides communication between the front panel and the Control Board. The Control Board lamp drivers (U14, U18, U19, and U43) and lamp latches control the lamps on the front panel.

Argon Gas Tank Detection and Measurement (Control Board, sheet 5 of 8)

The two separate tank detection circuits (U3, U6, and U9) determine whether a pressure transducer is connected to the Valleylab Argon Gas Delivery Unit II. There is a separate circuit for each of the two argon gas tank connectors. Two additional separate circuits (U1-U3, U6, and U8) measure the pressure within each tank. The tank detection circuits are identical.

A 10 V excitation is provided to the transducer bridge circuit. The sense voltage is then amplified and filtered. The A-D Converter changes this measurement from an analog to a digital value.

Pressure Transducers (Control Board, sheet 6 of 8 and sheet 7 of 8)

Two of the pressure transducer circuits (PS1-PS3, U25-U27, U30-U32, U35, and U36) measure the pressure seen by the orifice assembly at the argon gas inlet chamber and the argon gas outlet chamber. The third pressure transducer circuit monitors the peritoneal cavity pressure. The analog pressure measurement is filtered and amplified before it is converted by the A-D Converter.

Overvoltage Monitors (Control Board, sheet 6 of 8)

Two overvoltage monitoring circuits (U41) continuously check the +5V and +12V lines to ensure they are within specification of the manufacturer. If either of the voltage lines becomes out of specification, the overvoltage monitor trips and shuts down the Valleylab Argon Gas Delivery Unit II. To clear this condition, turn off and then turn on the power to the unit.

A-D Converter (Control Board, sheet 6 of 8)

The A-D Converter (U39) receives analog inputs from the pressure transducers, overvoltage monitors, and tank measurement circuits. These inputs are converted to a digital format to be processed by the main microprocessor.

DC Power Connector (Control Board, sheet 6 of 8)

The DC power connector establishes the connection between the power supply and the Valleylab Argon Gas Delivery Unit II. A 45 watt universal input power supply is used in the unit. The unit can accept 85-264 Vac at 47-63 Hz without input range switching or other adjustment. The power supply provides +5V at 3 amps and +12V at 2 amps to the Valleylab Argon Gas Delivery Unit II.

IsoBloc Circuit Modules (Control Board, sheet 8 of 8)

The microcontroller responds to inputs from the front panel and from a handset and/or footswitch. The handset and footswitch connectors are isolated from the rest of the Valleylab Argon Gas Delivery Unit II with two completely separate IsoBloc circuits (U34, U50, and U51). This is necessary because the handswitch leads, in particular, may be elevated to relatively high RF voltages. To maintain isolation within the unit, these leads must not be coupled to ground.

Lamps and LEDs (Display Board, sheet 2 of 4)

The lamps for the **Gas Flow, Overpressure, Tank 1, Tank 2, Low Gas Flow, Standard Gas Flow,** and **Obstruction** indicators are controlled by the Control Board through the ribbon cable connector. The LEDs for **Gas On, Gas Off,** and **Low Pressure Alarm Tank**

1 and Tank 2 are controlled by an LED latch (U6) with commands from the main microprocessor. These commands are active low.

Switch Read Buffer (Display Board, sheet 2 of 4)

The switch read buffer (U3) receives inputs from the two rotary knobs and the six push buttons on the front panel. The buffer returns this information to the main microprocessor to change the state of the Valleylab Argon Gas Delivery Unit II according to input from the front panel.

Bar Graph Display Driver (Display Board, sheet 3 of 4)

When the tank transducer is connected, the bar graph display driver (U7) receives inputs from the main microprocessor to indicate the % argon gas available in each tank. The bar graph display driver, in conjunction with a digit driver (U4), also displays the user adjustable overpressure setpoint.

Seven Segment Display Driver (Display Board, sheet 4 of 4)

The seven segment display driver (U5) controls the flow and overpressure readings as indicated by the main microprocessor.

ESU Interface Connector (Footswitch Board, sheet 1 of 1)

When the user activates the handset or footswitch (K1-K4) in the cut or coag mode, the ESU interface connector sends signals to the associated electrosurgical generator through an external cable.

Footswitch Connector (Footswitch Board, sheet 1 of 1)

When connected to a footswitch, the footswitch connector activates the Valleylab Argon Gas Delivery Unit II.

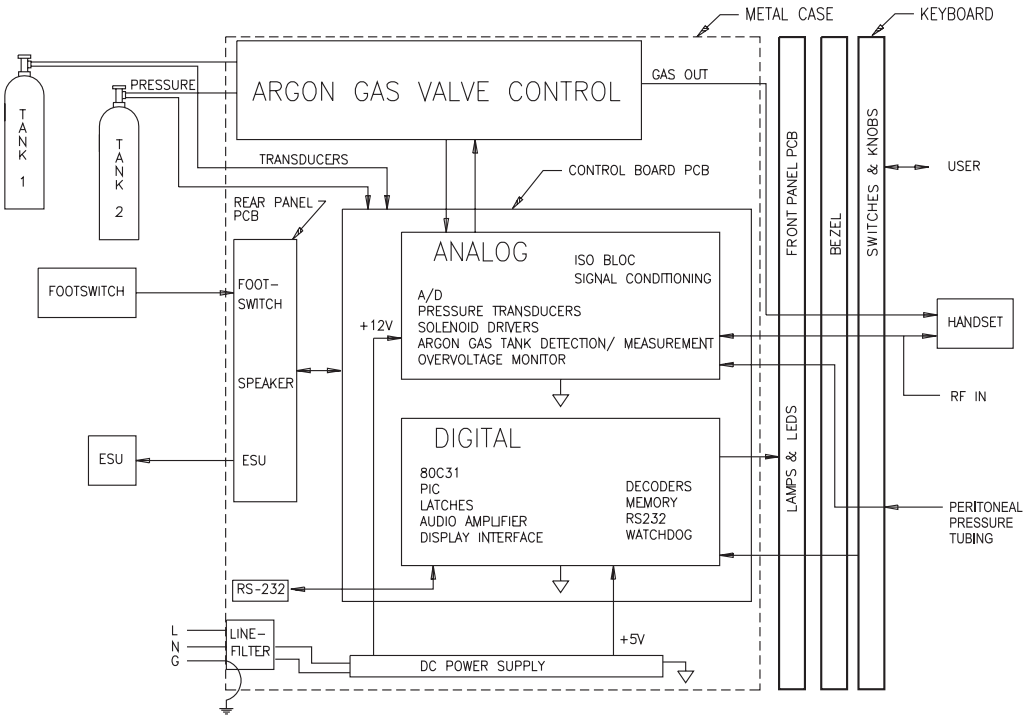
Speaker (Footswitch Board, sheet 1 of 1)

The speaker (SP1) for the alarm enunciator (located on the Control Board) is located on the Footswitch Board.

Software Initialization

Each time the Valleylab Argon Gas Delivery Unit II is turned on, the main microprocessor must initialize and the circuitry must warm up and stabilize. Hardware initialization takes a fraction of a second. Then the microcontroller starts the software initialization. All LEDs on the front panel illuminate for three seconds.

Valleylab Argon Gas Delivery Unit II Block Diagram



Chapter 5

Setup, Tests, and Adjustments

This chapter provides setup and test procedures to verify that the Valleylab Argon Gas Delivery Unit II System is functioning properly. Some test procedures require partial disassembly of the unit. Refer to Chapter 7 *Replacement Procedures* for disassembly instructions.

Setting up the Valleylab Argon Gas Delivery Unit II

Unpacking and Installing the Unit

1. Carefully remove the Valleylab Argon Gas Delivery Unit II and all accessories from the shipping packages. Save cartons and packing materials for use if the unit is returned for service.
2. Place the unit on any stable flat surface, such as a table, platform, or Valleylab cart. Carts with conductive wheels are recommended. Refer to the procedures for your institution or to local codes for details.
3. According to the procedures used by your institution, connect an equipotential grounding cable to the grounding lug on the rear panel of the unit. Then, connect the cable to earth ground.
4. Plug the unit power cord into the rear panel receptacle. Secure the cord to the rear panel using the screw and C clamp provided.

Warning

Electric Shock Hazard: Connect the unit power cord to a properly grounded receptacle. Do not use power plug adapters.

Fire Hazard: Do not use extension cords.

Notice

Connect the power cord to a wall receptacle having the correct voltage. Otherwise, product damage may result.

5. Plug the unit power cord into a grounded receptacle. Grasp the plug, not the power cord. Do not pull on the cord itself.

Connecting the Argon Gas Tank(s)

Refer to Chapter 7 *Replacement Procedures* for instructions on connecting the argon gas tanks to the Valleylab Argon Gas Delivery Unit II. Verify that the regulator to tank fitting has been installed into the high pressure regulator.

Warning

Use only the high pressure regulator supplied with the Valleylab Argon Gas Delivery Unit II. Replacement regulators should be ordered from Valleylab. Argon gas pressure should not exceed 434 KPa (63 psig) ± 5% at the regulator hose connection to the receptacle on the rear panel.

Constructing an Extended Length Argon Gas Supply Hose

An extended supply hose may be required to access a remote argon gas supply source.

Warning

Use only high purity grade (99.998% pure or better) argon gas. Patient safety may be compromised by using low purity gas.

High Pressure Hazard: Ensure that argon gas tanks and fittings used with the Valleylab Argon Gas Delivery Unit II have been pressure tested, certified, and filled according to applicable standards and local codes. In filling the tanks, ensure your supplier meets all local and national codes. Do not over pressurize the tanks. Do not exceed 2,000 psig.

The regulator coupling in this unit is compatible with many common gas tanks (e.g., Freon®, helium, krypton, neon, nitrogen, and xenon). Only connect argon gas to the Valleylab Argon Gas Delivery Unit II. Using other gases may affect gas flow, create phosgene or other harmful gases, or create an explosion hazard.

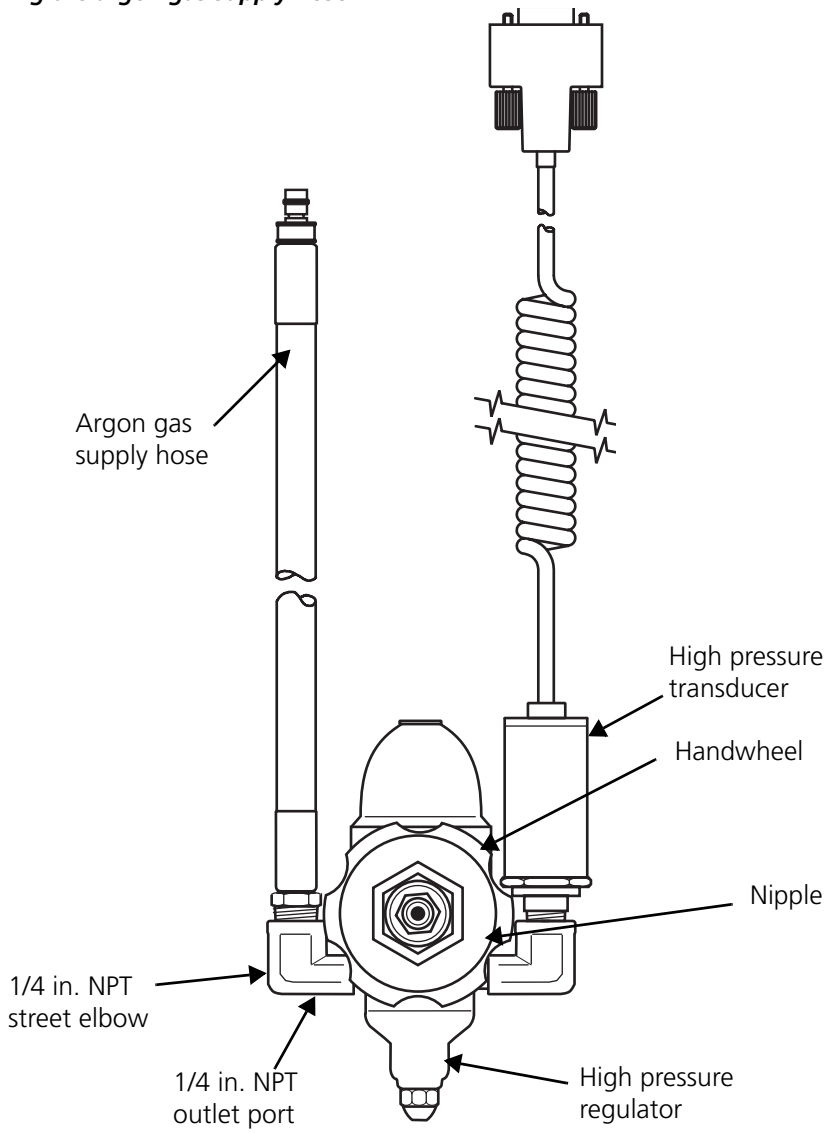
Removing the argon gas supply hose from the Valleylab Argon Gas Delivery Unit II System

Equipment:

- Wire brush for cleaning threads.
- Two wrenches to fit applicable hose fittings.

1. Disconnect the Valleylab Argon Gas Delivery Unit II high pressure regulator assembly from the argon gas tank.
   - Follow the appropriate safety precautions for handling high pressure gas tanks. If applicable, obtain the tank safety cap before proceeding.
   - Make sure the Valleylab Argon Gas Delivery Unit II is off, the electrosurgical generator is off or in standby, and the valves on both argon gas tanks are completely closed.
   - It is normal for a small amount of argon to escape during this procedure. To disconnect the high pressure regulator assembly from the tank, hold the regulator assembly stationary while you loosen the regulator coupling with a wrench. If applicable, attach the safety cap to the top of the unused tank.
2. Disconnect the argon gas supply hose at the quick connect fitting on the rear panel of the Valleylab Argon Gas Delivery Unit II.
3. Disconnect the Valleylab Argon Gas Delivery Unit II argon gas supply hose from the outlet port of the high pressure regulator.
4. Remove the 1/4 in. NPT street elbow from the outlet port of the high pressure regulator. If reusing the 1/4 in. NPT street elbow, clean all threads of old thread sealant.
5. Clean old thread sealant from the 1/4 in. NPT hose fitting and the 1/4 in. FNPT regulator threads.

Removing the argon gas supply hose



Connecting the Electrosurgical Generator and Accessories

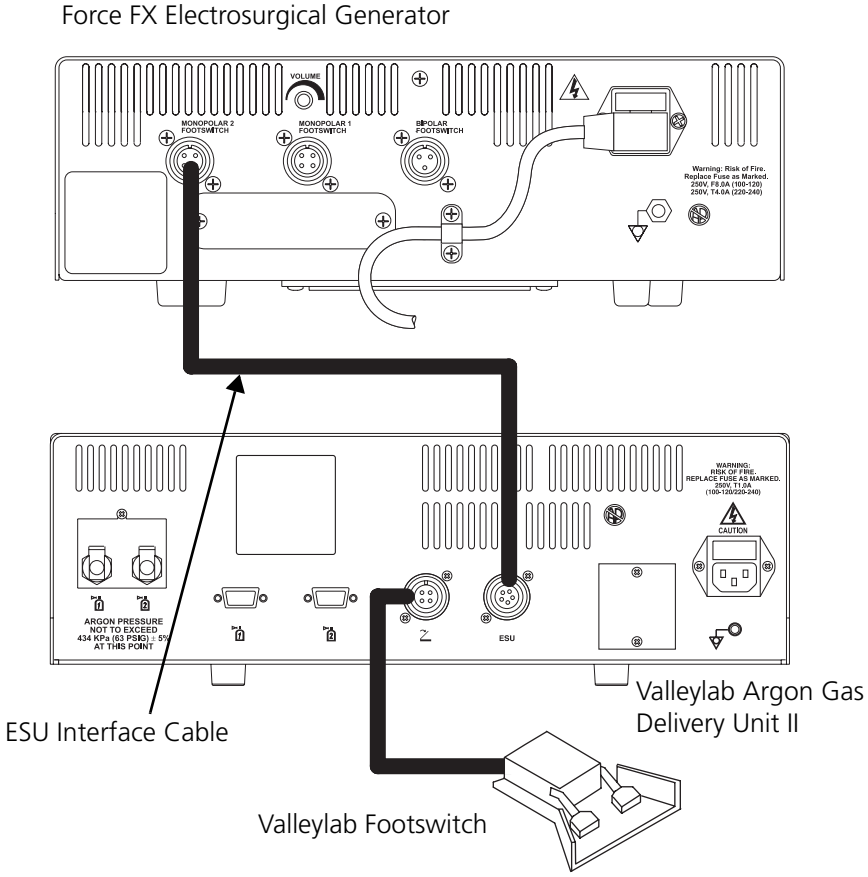
A Force series electrosurgical generator should be used with the Valleylab Argon Gas Delivery Unit II. Refer to the electrosurgical generator's user's guide or instruction manual for detailed setup information. The electrosurgical generator may be stacked on top of the Valleylab Argon Gas Delivery Unit II.

Important

When using the Force FX generator, connect the ESU interface cable to either the Monopolar 1 or 2 footswitch receptacle on the generator rear panel. The connected footswitch activates monopolar output for the instrument connected to the corresponding numbered receptacle on the front panel. Use only a Valleylab footswitch with the Force Argon-II. Use of an incompatible footswitch may cause unexpected output.

1. Plug the electrosurgical generator into a hospital grade power receptacle.
2. Connect the ESU interface cable to the Valleylab Argon Gas Delivery Unit II and the electrosurgical generator rear panels.

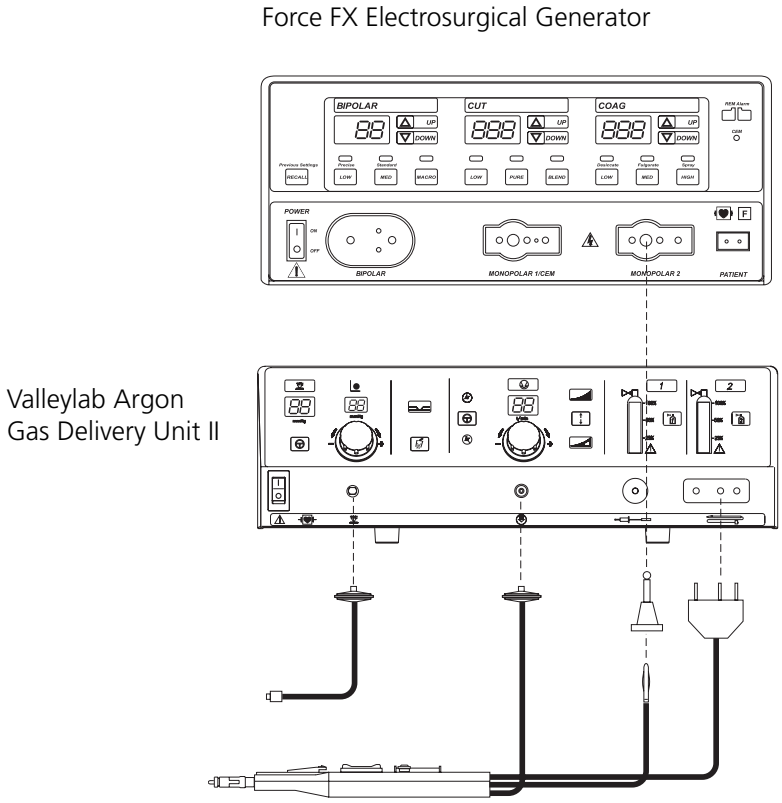
Connecting the Valleylab Argon Gas Delivery Unit II and electrosurgical generator


Force FX Electrosurgical Generator
VOLUME
MONOPOLAR 2 FOOTSWITCH
MONOPOLAR 1 FOOTSWITCH
BIPOLAR FOOTSWITCH
Warning: Risk of Fire. Replace Fuse as Marked. 250V, F8.0A (100-120) 250V, T4.0A (220-240)
WARNING: RISK OF FIRE. REPLACE FUSE AS MARKED. 250V, T1.0A (100-120/220-240)
CAUTION
ARGON PRESSURE NOT TO EXCEED 434 KPa (63 PSIG) ± 5% AT THIS POINT
ESU
ESU Interface Cable
Valleylab Argon Gas Delivery Unit II
Valleylab Footswitch

Connect a handset to the system. The graphic below illustrates how to connect the Argon Handset.

Important
Argon-enhanced coag will not function properly in low voltage Desiccate coag. Before using argon-enhanced coag, be sure that the generator is set in the correct coag mode. Force EZ – Fulgurate coag Force FX – Spray coag

Connecting the Argon Plus Handset



General Test Information

Valleylab recommends that the Valleylab Argon Gas Delivery Unit II be inspected and functionally checked once a year.

Warning

Electric Shock Hazard: The front heatsink on the power supply is at an elevated voltage. Do not come in contact with it. Do not use it for ground.

Take appropriate precautions (such as use of isolated tools and equipment; use of the "one hand rule," etc.) when taking measurements or troubleshooting the unit.

Electric Shock Hazard: Do not touch any exposed wiring or conductive surface while the unit is disassembled and energized.

Caution

The unit contains electrostatic sensitive components. When repairing the unit, work at a static control workstation. Wear a grounding strap when handling electrostatic sensitive components. Handle the circuit boards by their nonconductive edges. Use an antistatic container for transport of electrostatic sensitive components and circuit boards.

When testing, follow proper testing procedures in order to duplicate manufacturer test data. Keep test leads as short as possible. Lead inductance and stray capacitance can affect meter readings adversely. Use of uncompensated scope probes may cause large errors in measurements. When measuring microampere leakage currents, accidental capacitive or inductive coupling may cause order-of-magnitude error in the observed values.

Recommended Test Equipment

You will need the following equipment to perform the checks described in this chapter. If substitute equipment is used, it must meet or exceed the specifications of the recommended equipment.

Description	**Specifications**
Electrosurgical generator	Force EZ or Force FX Generator
Two bottles of argon	With known gas pressures (within 100 psig)
Cylinder pressure	0 - 2000 psi cylinder pressure, 57 - 75 psi delivery pressure gauge/regulator
Gas pressure gauge	0 - 100 (min.) psig
ESU interface cable	
Argon Handset	
Valleylab Argon Accessory	
Banana plug	

Mechanical Inspection

The following inspection assumes that you are familiar with the unit's controls, indicators, and receptacles.

Front Panel Controls

1. Ensure that the unit is not connected to power.
2. Check the following receptacles for damage or corrosion:
   - **AR Gas** (male luer lock)
   - **Peritoneal Pressure Tubing** (female luer lock)
   - **RF Input**
   - **Handset**
3. Using a banana plug, check the **RF Input** and **Handset** receptacles for obstructions and secure fit.
4. Check the **On/Off** switch for damage or corrosion.

Rear Panel Connectors

Verify that all connectors are properly and securely tightened.

Power Cord

The Valleylab Argon Gas Delivery Unit II is supplied with a hospital grade power connector. The Valleylab representative in your country will equip your unit with the proper connector for your operating room. The power connector meets all requirements for safe grounding. Its purpose should not be defeated by using extension cords or three-prong to two-prong adapters.

Periodically check the power cord assembly for damaged insulation or connectors. Always grasp cords by the connector. Do not pull on the cord itself.

Clean the power cord with a damp cloth and mild detergent. Let the power cord dry completely, and install the power cord assembly.

Warning

Electric Shock Hazard Do not install a wet power cord assembly into the unit or into a wall receptacle.

Initialization Sequence

This test verifies that the Valleylab Argon Gas Delivery Unit II turns on and performs the initialization sequence (self-test) properly. Before beginning this test, verify that:

- The Valleylab Argon Gas Delivery Unit II is connected to the electrosurgical generator and both are plugged into hospital grade grounded receptacles.
- At least one argon gas tank is attached to the unit (pressure must be greater than 300 psig). Valleylab recommends attaching two argon gas tanks to complete all test steps.
- A handset is connected to the system.

1. Open the argon gas tank valve.
2. Press the unit power switch to the on position.
3. The unit conducts the initialization sequence. Check the following:
   - All LED indicators and lamps illuminate for approximately three seconds.
   - The Valleylab Argon Gas Delivery Unit II will purge the handset at 3 LPM.
4. After the initialization sequence, verify that:
   - A single tone sounds.
   - The **Flow Rate** display is dashed (– –).
   - The **Gas Off** indicator illuminates.
   - The **Low Gas Flow** indicator illuminates.
   - The **Peritoneal Pressure** display flashes 0.
   - The **Overpressure Setpoint** display indicates 5.

Functional Test with Gas

This test verifies that the Valleylab Argon Gas Delivery Unit II System functions properly when it is turned on and used with gas. Test the Valleylab Argon Gas Delivery Unit II with a Valleylab Argon Handset. If the unit does not perform as described in this test, refer to Chapter 6 *Troubleshooting* for further information. For complete instructions regarding use of the Force electrosurgical generator, refer to the appropriate user's guide. Before beginning this test, verify that:

- The Valleylab Argon Gas Delivery Unit II is connected to the electrosurgical generator and both are plugged into hospital grade grounded receptacles.
- At least one argon gas tank is attached to the unit (pressure must be greater than 300 psig). Valleylab recommends attaching two argon gas tanks to complete all test steps.
- A handset is connected to the system.

Step 1 –Turn on the electrosurgical generator and place it in the ready mode.

1. Press the electrosurgical generator power switch to the on position.
2. After the generator performs a self-test, short the generator **Patient** receptacle.
3. Press the generator **Ready** button (if applicable).
4. Ensure that all generator power levels are set at 1.

Step 2 –Turn on the Valleylab Argon Gas Delivery Unit II.

Refer to *Initialization Sequence* on page 5-10.

Step 3 –Verify that the unit controls function properly in the standard gas flow mode.

1. To select standard gas flow, press the **Gas Range Flow** selector on the front panel. Verify that the **Standard Gas Flow** indicator illuminates. The Valleylab Argon Gas Delivery Unit II sounds one tone.
2. To turn the gas on, press the **Gas On/Gas Off** button. Verify that the **Gas On** indicator illuminates.
3. Turn the **Flow Control** knob. Verify that the display changes from 0.5 to 12 and from 12 to 0.5. Set the gas flow to 1.
4. Ensure that both gas tank valves are open. Press the **Tank Select 1** button and then the **Tank Select 2** button. Verify that both tanks have sufficient pressure. Verify that the unit toggles between tank 1 and tank 2.
5. Press and release the **Gas Line Purge** button. Verify that the **Gas Flow** indicator illuminates for one to two seconds, and that the unit discharges argon through the gas tubing.
6. Turn the gas off by pressing the **Gas On/Gas Off** button. Verify that the **Gas Off** indicator illuminates.

Step 4 –Verify gas flow and electrosurgical generator control.

1. Turn on the gas at the handset. Verify that the **Gas On** indicator illuminates and that a single tone sounds.
2. Using the **Flow Control** knob, set the gas flow to 5.
3. Press the yellow cut and blue coag buttons. Verify that the generator activates, and that gas flows to the handset when activating cut and coag.
4. Turn off the gas at the handset. Verify that the **Gas Off** indicator illuminates, and that a tone sounds. Press the yellow cut and blue coag buttons, and verify that no gas flows to the handset.

Step 5 –Verify that the gas line obstruction alarm functions properly.

1. Turn on the gas at the handset. Verify that the **Gas On** indicator illuminates and that a tone sounds.
2. Verify that the gas flow is still set at 5.
3. Press the yellow cut button or the blue coag button on the handset. While gas flows to the handset, pinch the gas line to obstruct the gas flow. Verify the following:
   - The **Obstruction** indicator illuminates.
   - The **Gas Flow** indicator flashes.
   - An alarm sounds until you release the cut or coag button.
   - The gas line depressurizes (may be hard to detect).
4. With the gas line still pinched, press the yellow cut button or the blue coag button on the handset. Verify that the alarm recurs. Release the pinched gas line.

Step 6 –Verify that the low pressure alarms operate properly.

1. Close both tank valves. Turn the **Flow Control** knob to set the gas flow to 12. Press the yellow cut button on the handset.
2. Observe an apparent decrease in the pressure of the tank being used. Verify that the **Low Pressure Alarm** indicator illuminates for the tank below 10%.
3. Observe a tank switch when the pressure is below 5% and the **Low Pressure Alarm** indicator flashes.
4. Continue to press the yellow cut button on the handset. Verify that the Low Pressure Alarm indicator illuminates for the second tank below 10%.
5. Verify that both **Low Pressure Alarm** indicators flash and that an alarm sounds when both tanks are shown as being below 5%.
6. Turn off the gas at the handset.
7. Press the yellow cut button on the handset. Verify that the generator's yellow **Cut** indicator illuminates.
8. Press the blue coag button on the handset. Verify that the generator's blue **Coag** indicator illuminates.
9. Open both tank valves; the alarm should clear.

Step 7 –Verify that the footswitch operates properly.

1. Connect the footswitch to the Valleylab Argon Gas Delivery Unit II. Do not plug the footswitch connector into the electrosurgical generator.
2. Turn the gas back on with the **Gas On/Gas Off** button. Verify that the **Gas On** indicator illuminates.

3. Press the left pedal. Verify that the handset operates in cut.
4. Press the right pedal. Verify that the handset operates in coag.

Step 8 –Verify that the unit controls function properly in the low gas flow mode (test only with the Argon Handset).

1. To select low gas flow, press the **Gas Range Flow** selector on the front panel. Verify that the **Low Gas Flow** indicator illuminates. A tone sounds once.
2. If the gas is not on, press the **Gas On/Gas Off** button. Verify that the **Gas On** indicator illuminates.
3. Turn the **Flow Control** knob. Verify that the display changes from 0.5 to 4 and from 4 to 0.5. Set the gas flow to 1.
4. Press and release the **Gas Line Purge** button. Verify that the **Gas Flow** indicator illuminates for one to two seconds, and that the unit discharges argon through the gas tubing.
5. Verify that the **Overpressure Setpoint** display indicates 5. Verify that the **Peritoneal Pressure** display flashes 0.
6. Connect the peritoneal pressure tubing to the **Peritoneal Pressure Tubing** receptacle.
7. Turn the **Overpressure Contro**l knob. Verify that the **Overpressure Setpoint** display changes from 5 to 30. Set the setpoint to 5.
8. Obstruct the peritoneal pressure tubing and activate the handset. Verify the following:
   - The **Obstruction** indicator illuminates.
   - The **Overpressure** indicator flashes.
9. To clear the alarm condition, deactivate cut or coag, then remove the obstruction.

Step 9 –Verify gas flow and electrosurgical generator control in low gas flow mode.

1. If it is not already on, turn on the gas at the handset. Verify that the **Gas On** indicator illuminates.
2. Verify that the argon unit is still in low flow mode, then turn the Flow Control knob to 4.
3. Press the yellow cut and blue coag buttons. Verify that the generator activates, and that gas flows to the handset when activating cut and coag.
4. Turn off the gas at the handset. Verify that the **Gas Off** indicator illuminates, and that a tone sounds. Press the yellow cut and blue coag buttons, and verify that no gas flows to the handset.

Step 10 –Verify that the gas line obstruction alarm functions properly in the low gas flow mode.

1. Turn on the gas at the handset. Verify that the Gas On indicator illuminates and that a tone sounds.
2. Turn the **Flow Control** knob to set the gas flow to 1.
3. Press the yellow cut button or the blue coag button on the handset. While gas flows to the handset, pinch the gas line to obstruct the gas flow. Verify the following:
   - The **Obstruction** indicator illuminates.
   - The **Gas Flow** indicator flashes.
   - An alarm sounds until you release the cut or coag button.
   - The gas line depressurizes (may be hard to detect).
4. With the gas line still pinched, press the yellow cut button or the blue coag button on the handset. Verify that the alarm recurs. Release the pinched gas line.

Step 11 –Turn off the unit and the electrosurgical generator.

1. Press the Valleylab Argon Gas Delivery Unit II power switch to the off position.
2. Press the generator power switch to the off position.
3. Remove the Argon Handset and the peritoneal pressure tubing or the Valleylab Argon Accessory from the unit and the electrosurgical generator.

Chapter 6

Troubleshooting

If the unit is not functioning properly, use the information in this chapter to perform the following:

- If an error code number was displayed, take the appropriate action to correct the error condition.
- Test the Power Supply Board.
- Test the cable connection.
- Test the Footswitch Board.
- Test all buttons, indicators, and knobs on the front panel.
- Test the argon valve assembly.

Inspecting the Valleylab Argon Gas Delivery Unit II

If the unit malfunctions, first check for obvious conditions that may have caused the problem.

- Check the unit for visible signs of physical damage.
- Verify that all accessory cords are properly connected.
- Check the power cord. Replace the power cord if you find exposed wires, cracks, frayed insulation, or a damaged connector.
- Open the fuse drawer and inspect the fuse housing and fuses for damage and corrosion. Verify that the fuses are firmly seated.

An internal component malfunction in the unit can damage the fuses. You may need to replace the fuses if the unit fails the initialization sequence or stops functioning. Refer to Chapter 7, *Replacement Procedures* for fuse replacement information.

Warning

Electric Shock Hazard Do not touch any exposed wiring or conductive surface while the unit is disassembled and energized. Never wear a grounding strap when working on an energized unit. Disconnect the power cord before replacing parts. The front heatsink on the power supply is at an elevated voltage. Do not come in contact with it. Do not use it for ground.

Caution

The unit contains electrostatic sensitive components. When repairing the unit, work at a static control workstation. Wear a grounding strap when handling electrostatic sensitive components. Handle the circuit boards by their nonconductive edges. Use an antistatic container for transport of electrostatic sensitive components and circuit boards.

Error Codes

Nonfatal Warnings

When a nonfatal error code exists, a short tone sounds, the letters "ER" flash in the **Peritoneal Pressure** display, and the error code number flashes in the **Flow Rate** display. Most nonfatal errors require some action on your part to correct the condition. Others are corrected automatically.

Use the table below to determine how to respond to the error condition. After pressing the Gas Line Purge button, the unit will repeat the purge cycle and all nonfatal error conditions will clear.

Number	Description	Recommended Action
28	PS1 offset out of range. P1_OFFSET_ERR	Press the **Gas Line Purge** button.
29	PS2 offset out of range. P2_OFFSET_ERR	
30	PS3 offset out of range. P3_OFFSET_ERR	
90	Tank empty during purge. TNK_EMPTY_ERR	**1.** Verify that the transducer and gas tank are connected properly. Verify the tank has sufficient argon gas. **2.** Verify that the tank valve is open. **3.** Press the **Gas Line Purge** button.
91	P2 plenum not zero before purge. P2_VENT_ERR	Press the **Gas Line Purge** button.
92	The purge cycle started with the handset in the peritoneal cavity. P3_CHK_ERR	**1.** Verify that gas line calibration is performed in open air, not in the peritoneal cavity. **2.** Press the **Gas Line Purge** button.
93	Handset not connected properly or the handset particle filter punctured. PURGE_P3_LOW_ERR	**1.** Verify that the handset is connected properly. **2.** Press the **Gas Line Purge** button. **3.** If the condition is not corrected, replace the handset.
94	Handset tubing is obstructed or the handset particle filter is clogged. PURGE_P2_HI_ERR	**1.** Verify that the handset tubing is not obstructed. **2.** Press the **Gas Line Purge** button. **3.** If the condition is not corrected, replace the handset.

Fatal Warnings

When a fatal error exists, the following conditions occur:

- All lamps on the front panel flash.
- A tone sounds continuously.
- The front panel buttons do not function.
- The unit does not receive input from handset or footswitch activation.
- The letters "ER" flash in the **Peritoneal Pressure** display, and the error code number flashes in the **Flow Rate** display.

Use the table below to determine how to respond to the error condition. Where indicated, contact the Covidien Service Center (1-800-255-8522).

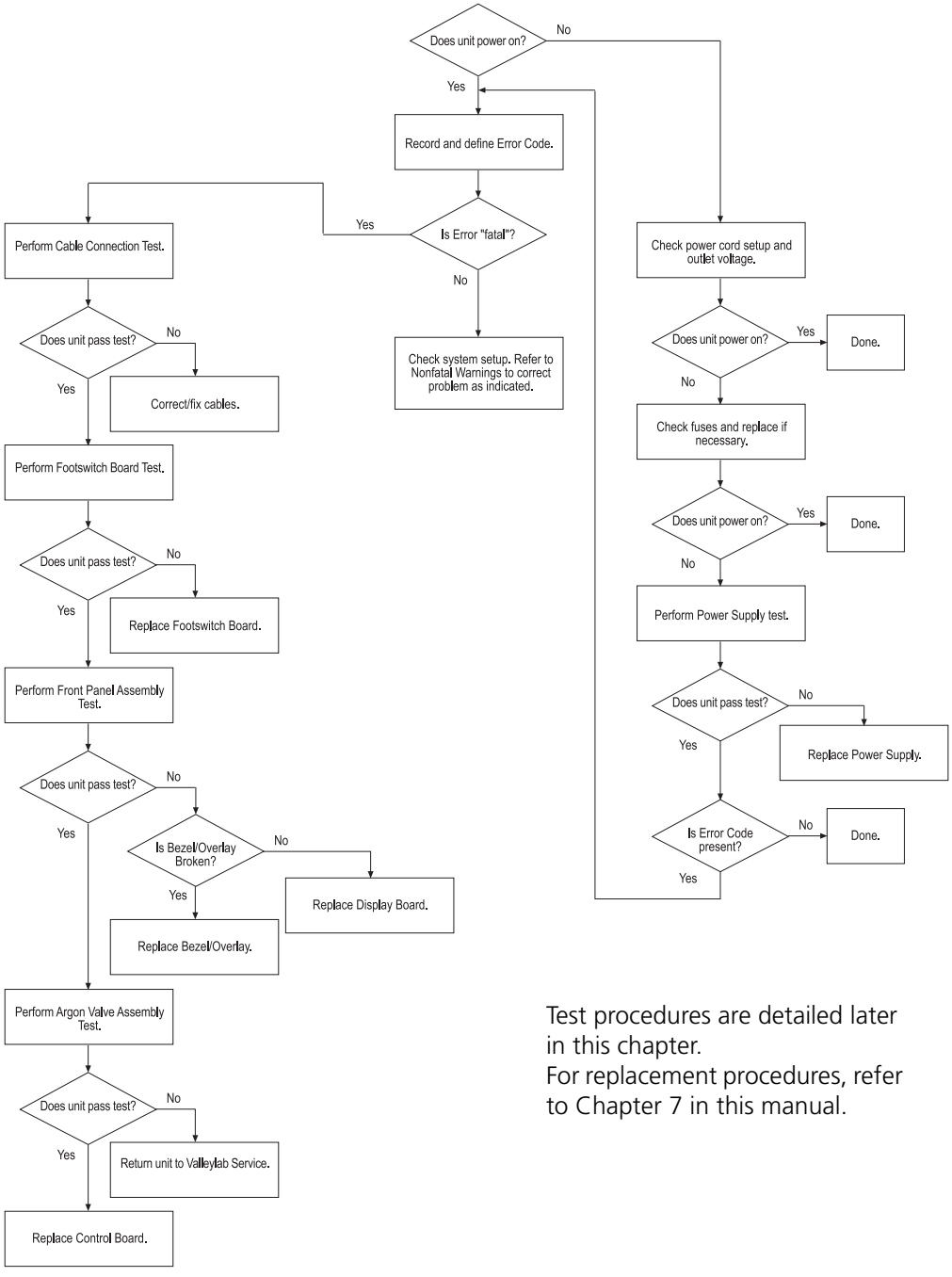
Number	Description	Recommended Action
01	RAM self-test error. X_RAM_TST_FAIL	Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
02	ROM self-test error. X_ROM_TST_FAIL	
03	An input switch is stuck. STK_SWTCH_ERR	**1.** Release all switches. **2.** Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
04	Vref or +5dc out of range. A_D_TST_ERR	Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
05	Interprocessor communication test error. PIC_FAIL_ERR	
06	PIC and main oscillator frequency comparison test error. OSC_FREQ_ERR	
07	PIC enable test error. PIC_EN_TST_ERR	

Number	Description	Recommended Action
08	PIC disabled by internal jumper JP1. PIC_DISABLED_ERR	**1.** Reconnect PIC jumper inside the unit. **2.** Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
	Operating these LPM and flow solenoids in the absence of handset or footswitch activation result in the following: • During the diagnostic check, the PIC did not shut down. • The microprocessor did not receive subsequent flow rate information.	Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
09	.5 LPM and flow solenoids PIC_TST_ERR1	
10	1 LPM and flow solenoids PIC_TST_ERR2	
11	2 LPM and flow solenoids PIC_TST_ERR3	
12	4 LPM and flow solenoids PIC_TST_ERR4	
13	8 LPM and flow solenoids PIC_TST_ERR5	
	In the presence of a nonvalid setting for flow value, the PIC and/or microprocessor did not shut down.	Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
14	13 LPM in standard flow mode PIC_TST_ERR6	
15	5 LPM in low flow mode PIC_TST_ERR7	

Number	Description	Recommended Action
16	The PIC and/or microprocessor is not detecting an induced mismatch of complementary flow settings. PIC_TST_ERR8	Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
26	PS2 and PS3 did not compare within 10%. P2_P3_CHK_ERR	
27	PS1 and PS2 did not compare within 10%. P1_P2_CHK_ERR	
31	PS1 too high. P1_HIGH_ERR	
32	PS1 too low when tank pressure > 200 psi. P1_LOW_ERR	
40	Post boot-up PIC detected error. PIC_SHUTDOWN_ERR	Turn off, then turn on the unit (may have to repeat 2-3 times). Check all cable connections and front panel connections. If the alarm number reappears, record the number and call the Covidien Service Center.
45	P2 increased by more than 0.4 psi within 1/2 second after deactivating unit and stopping gas flow. ORIFICE_LKG_ERR	Turn off, then turn on the unit (may have to repeat 2-3 times). If the alarm number reappears, record the number and call the Covidien Service Center.
46	Pressure release solenoid did not vent unit. VENT_ERR	
55	Mode values do not match. MODE_CMP_ERR	
56	Flow setting values do not match. FLOW_CMP_ERR	
65	Display control () default error. DIS_CNTL_DFLT_ERR	
66	State variable out of range. STATE_VAR_RANGE_ERR	

Number	Description	Recommended Action
67	Mode is not TEST or NORMAL. MODE_RANGE_ERR	
68	Tank Select neither TANK1 or TANK2. TNK_SEL_DFLT_ERR	
69	Default for timer () interrupt. INT_CNT_ERR	
75	Ovp Mode variables corrupted and recovered. NV_OVP_MODE_RESTORED	
76	Ovp Mode variables corrupted and restored to default. NV_OVP_MODE_CORRUPTED	
77	Initialization check variables corrupted and recovered. EP_INIT_RESTORED	
78	Error buffer pointers corrupted and error queue emptied. ERR_BUF_PTR_CORRUPTED	
79	Non-volatile memory access failure. NV_MEM_ACCESS_ERR	

Error code troubleshooting



Test procedures are detailed later in this chapter.
For replacement procedures, refer to Chapter 7 in this manual.

Error Code Download

An error code history is available with a maximum capacity of 32 error and warning codes. The error log is presented in time sequence with the earliest recorded errors being displayed first. When the error buffer is full, the oldest errors will be written over. Errors in the error log are displayed as hexadecimal numbers. For conversion of hexadecimal values to decimal equivalents, refer to the table below.

An RS-232 port is provided on the rear panel for interfacing to a terminal. To download error codes:

1. Remove the RS-232 cover plate from the Valleylab Argon Gas Delivery Unit II rear panel.
2. Interface from the RS-232 port to a Terminal Emulator.
3. Turn on the Valleylab Argon Gas Delivery Unit II.
4. Send the command "DMP_ERR".
5. Review the error codes.
6. To exit the test mode, turn off, then turn on the Valleylab Argon Gas Delivery Unit II.

Hexadecimal Number	Decimal Equivalent	Hexadecimal Number	Decimal Equivalent
1 (hex)	01	1F (hex)	31
2 (hex)	02	20 (hex)	32
3 (hex)	03	28 (hex)	40
4 (hex)	04	2D (hex)	45
5 (hex)	05	2E (hex)	46
6 (hex)	06	37 (hex)	55
7 (hex)	07	38 (hex)	56
8 (hex)	08	41 (hex)	65
9 (hex)	09	42 (hex)	66
A (hex)	10	43 (hex)	67
B (hex)	11	44 (hex)	68
C (hex)	12	45 (hex)	69
D (hex)	13	4B (hex)	75
E (hex)	14	4C (hex)	76
F (hex)	15	4D (hex)	77

Hexadecimal Number	Decimal Equivalent
10 (hex)	16
1A (hex)	26
1B (hex)	27

Hexadecimal Number	Decimal Equivalent
4E (hex)	78
4F (hex)	79

Recommended Test Equipment

You will need this equipment to perform the following tests. If substitute equipment is used, it must meet or exceed the specifications of the recommended equipment.

Description	Specifications
Digital voltmeter	Fluke 77 or 87, or equivalent
Flow meters	0-20 LPM, 70° F and 1 atmospheric pressure (21° C and 760 torr), calibrated with argon gas - Sierra Instruments 821-S, or equivalent. 0-5 LPM, 70° F and 1 atmospheric pressure (21° C and 760 torr), calibrated with argon gas - Sierra Instruments 821-S, or equivalent.
Electrosurgical generator	Force EZ or Force FX Generator
Two bottles of argon	With known gas pressures (within 100 psig)
ESU interface cable	
Argon Handset	

Power Supply Board Test

Using a Digital Fluke Multimeter or equivalent, measure the following voltages. If the values are outside the specified range, replace the Power Supply Board.

- 5 Vdc supply between TP7 and TP10:
  4.95 ≤ measured voltage ≤ 5.25 VDC
- 12 Vdc supply between TP3 and TP10:
  11.64 ≤ measured voltage ≤ 12.36 VDC

Cable Connection Test

Inspect each cable for proper connection to the Valleylab Argon Gas Delivery Unit II System. If a cable has broken or missing wires or connections, replace the cable.

Footswitch Board Test

The following two tests verify the integrity of the Footswitch Board.

Footswitch Test

1. Connect a Valleylab footswitch to the 4-pin connector on the rear panel of the Valleylab Argon Gas Delivery Unit II.
2. Using a Digital Fluke Multimeter or equivalent, measure the resistance between pins 1 and 3 on J1. The resistance should have infinite impedance.
3. Activate cut on the footswitch and measure the resistance between pins 1 and 3 on J1. The resistance should be less than 10 ohms.
4. Using a Digital Fluke Multimeter or equivalent, measure the resistance between pins 2 and 3 on J1. The resistance should have infinite impedance.
5. Activate coag on the footswitch and measure the resistance between pins 2 and 3 on J1. The resistance should be less than 10 ohms.

ESU Interface Test

1. Connect the ESU interface cable to the Valleylab Argon Gas Delivery Unit II and the electrosurgical generator rear panels.
2. Turn on the generator.
3. Disconnect the connector at J3 on the Footswitch Board.
4. Apply 12Vdc between pins 1 and 2 on J3 on the Footswitch Board.
5. The cut mode should activate.
6. Remove the 12Vdc and the cut mode should deactivate.
7. Apply 12Vdc between pins 1 and 5 on J3 on the Footswitch Board.
8. The coag mode should activate.
9. Remove the 12Vdc and the coag mode should deactivate.

Front Panel Test

A front panel test feature is available to test all buttons, indicators, and knobs. To access this feature:

1. Remove the RS-232 cover plate from the Valleylab Argon Gas Delivery Unit II rear panel.
2. Interface from the RS-232 port to a Terminal Emulator.
3. Turn on the Valleylab Argon Gas Delivery Unit II.
4. Send the command "SET_TST" to enter the test mode.
   - Flow Setting Encoder Actions

     In the test mode, the Flow Setting Encoder increments the **Flow Rate** display from 0.5 to 12 in the following steps: 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 11, 12.

     The **Gas Flow, Tank 1**, and **Tank 2** indicators sequentially illuminate as the Flow Setting Encoder is rotated. The sequence starts with the **Gas Flow** indicator illuminated when the **Flow Rate** display reads 0.5.
   - OVP Threshold Encoder Actions

     When in the test mode, the OVP Threshold Encoder increments the **Overpressure Setpoint** display over the range of 1 to 30.
   - Button Actions

     During the test mode, press the front panel buttons to verify that specific actions occur. Refer to the following table.

If an indicator does not illuminate, replace the Display Board assembly. If a button does not activate, replace the front panel assembly.

Button	**Action**
Handset gas on	**Gas On** indicator illuminated
Handset gas off	**Gas Off** indicator illuminated
Gas On/Off button	Toggles between **Gas On** and **Gas Off** indicators
Gas Flow Range Selector	When released, **Standard Gas Flow** indicator illuminates. When pushed, **Low Gas Flow** indicator illuminates.
Gas Line Purge button	**Obstruction** indicator illuminates
Tank 1 Select button	**Tank 1 Low Pressure Alarm** indicator illuminates
Tank 2 Select button	**Tank 2 Low Pressure Alarm** indicator illuminates

5. To exit the test mode, turn off, then turn on the Valleylab Argon Gas Delivery Unit II.

Argon Control Assembly Test

The following tests isolate any malfunction (valves not opening on commands from the microprocessor) of the argon control assembly independent of the Control Board. Complete all steps in each test sequence. If any of the tests fail, return the unit to Covidien for service. **Do not attempt to service the solenoid valves of the argon control assembly**.

Description of Valve Operation

After the initialization sequence, the valves function as described below.

Condition	The unit power remains on.
Function	The tank 1 or tank 2 selector valve remains open.
Conditions	The flow rate is set. The argon gas is turned on (at the front panel). The handset is activated.
Function	The orifice valve(s) and flow control valve operate. If argon gas leaks through one of the five orifice valves 0.5, 1.0, 2.0, 4.0, and 8.0 LPM) when the handset is not activated, a dosage error is detected.
Conditions	An obstruction condition is corrected. The handset is deactivated
Function	The release valve operates.
Condition	The low gas flow range is selected.
Function	To check for patient peritoneal pressure line occlusion, the peritoneal directional valve (P3) operates at the initial handset activation and at 5 second intervals.

Test Setup

1. Disconnect the power cord from the AC inline filter.
2. Remove the 4 Phillips screws securing the top cover to the unit. Remove the cover.
3. Attach the filter end of the Argon Handset to the **Gas Line** receptacle on the front panel.
4. To indicate argon gas flow, place the distal end of the handset into a beaker of tap water. If actual gas flow rate measurement is desired, connect a mass flow meter to the distal end of the handset. To ensure correct readings, use a mass flow meter calibrated for argon gas at 50 psia. at 70° F.

5. Using two argon gas tanks (pressure greater than 10%) and Valleylab Argon Gas Delivery Unit II high pressure regulator assemblies, connect one tank to the **Tank 1** receptacle and one tank to the **Tank 2** receptacle on the rear panel. The test can be completed using only tank 1; however, the tank 2 solenoid valve cannot be tested.
6. Disconnect the 20-pin solenoid connector located at J4 on the Control Board.
7. Turn on the argon gas supply for both tanks.
8. Position a 12 Vdc calibrated supply with three sets of leads within connection distance of the 20-pin solenoid connector.

Notice

Do not leave 12 Vdc applied to solenoid valves in excess of 30 minutes.Equipment damage may result.

Testing Tanks 1 and 2, and the Release Solenoid Valves

Tank 1 and Tank 2

1. Disconnect the 90° union fitting from the distal end of the argon filter. Argon should not flow.
2. To activate the tank 2 solenoid valve, apply 12 Vdc to terminals 3 and 4 of the 20-pin connector. Argon gas should flow at an unspecified rate from the argon filter. Disconnect 12 Vdc.
3. To activate the tank 1 solenoid valve, apply 12 Vdc to terminals 1 and 2 of the 20-pin connector. Argon gas should flow at an unspecified rate from the argon filter. Disconnect 12 Vdc.
4. Reconnect the 90° union fitting to the distal end of the argon filter.
5. To activate the tank 1 solenoid valve, apply 12 Vdc to terminals 1 and 2 of the 20-pin connector.
6. To activate the release solenoid valve, apply 12 Vdc to terminals 17 and 18 of the 20-pin connector. Argon gas should flow at an unspecified rate from the release valve into atmosphere. The argon gas will exit to atmosphere between the argon control valve and the right side of the base.
7. Disconnect 12 Vdc from the 20-pin terminals.

Testing the Orifice and Flow Control Solenoid Valves

1. To activate the tank 1 solenoid valve, apply 12 Vdc to terminals 1 and 2 of the 20-pin connector. Argon gas should not flow.
2. To activate the 0.5 LPM solenoid valve, apply 12 Vdc to terminals 5 and 6 of the 20-pin connector. Argon gas should not flow.
3. To activate the flow control solenoid, apply 12 Vdc to terminals 15 and 16 of the 20 pin connector. Argon should flow through the handset at a rate of 0.5 LPM ± 15%.

4. Disconnect 12 Vdc from terminals 5 and 6.
5. To activate the 1.0 LPM solenoid valve, apply 12 Vdc to terminals 7 and 8 of the 20-pin connector. Argon should flow through the handset at a rate of 1.0 LPM ± 15%.
6. Disconnect 12 Vdc from terminals 7 and 8.
7. To activate the 2.0 LPM solenoid valve, apply 12 Vdc to terminals 9 and 10 of the 20-pin connector. Argon should flow through the handset at a rate of 2.0 LPM ± 15%.
8. Disconnect 12 Vdc from terminals 9 and 10.
9. To activate the 4.0 LPM solenoid valve, apply 12 Vdc to terminals 11 and 12 of the 20-pin connector. Argon should flow through the handset at a rate of 4.0 LPM ± 15%.
10. Disconnect 12 Vdc from terminals 11 and 12.
11. To activate the 8.0 LPM solenoid valve, apply 12 Vdc to terminals 13 and 14 of the 20-pin connector. Argon should flow through the handset at 8.0 LPM ± 15%.
12. Disconnect 12 Vdc from terminals 13, 14, 15, and 16. Argon gas should not flow. Disconnect 12 Vdc from terminals 1 and 2.

Testing the Peritoneal Directional Solenoid Valve

This test will require a fourth set of power supply leads.

1. At the P3 solenoid valve push lock fitting, disconnect the argon tubing marked P3 (Control Board P3 transducer to argon control valve tubing).
2. To activate the tank 1 solenoid valve, apply 12 Vdc to terminals 1 and 2 of the 20-pin connector.
3. To activate the 4.0 LPM solenoid valve, apply 12 Vdc to terminals 11 and 12 of the 20-pin connector. Argon should not flow.
4. To activate the flow control solenoid valve, apply 12 Vdc to terminals 15 and 16 of the 20-pin connector. Argon should flow through the handset at a rate of 4.0 LPM ± 15%.
5. To activate the peritoneal directional solenoid valve, apply 12 Vdc to terminals 19 and 20 of the 20-pin connector.
6. Pinch off the handset tubing while argon gas is flowing. Argon should flow through the peritoneal directional solenoid valve at the point where the P3 tubing was removed in step 1. Disconnect 12 Vdc from the 20-pin terminals.

Chapter 7

Replacement Procedures

Follow the procedures in this chapter when you need to replace the parts listed below:

- front bezel and Display board
- power switch
- Power Supply Board
- Footswitch Board
- AC inline filter
- internal argon filter
- argon control valve assembly/second state regulator
- Control Board
- fuses
- argon gas tanks

Required Equipment

You will need the following equipment to perform the repairs described in this chapter. The specific equipment required for each procedure is listed at the beginning of that procedure.

- Phillips screwdriver
- flat blade screwdriver
- wrenches – open ended 1/2 in., 5/8 in., and 9/16 in.
- hose clamp pliers
- vise
- thread sealing tape, PTFE (polytetraflouroethylene)
- Crescent wrench

Warning

Electric Shock Hazard Disconnect the power cord before replacing parts.

Electric Shock Hazard The front heatsink on the power supply is at an elevated voltage. Do not come in contact with it. Do not use it for ground.

Caution

The unit contains electrostatic sensitive components. When repairing the unit, work at a static control workstation. Wear a grounding strap when handling electrostatic sensitive components. Handle the circuit boards by their nonconductive edges. Use an antistatic container for transport of electrostatic sensitive components and circuit boards.

Valleylab Argon Gas Delivery Unit II Spare Components

Refer to Chapter 9, *Service Parts* for the part numbers of these spare components. When you order one of these replacement parts, preface the nine digit part number with an "S."

- Control Board Assembly
- Display Board Assembly
- Footswitch Board Assembly
- Front Bezel and Display Board Assembly
- Regulator Tank 1

Front Bezel and Display Board Replacement

Equipment required

- Phillips screwdriver
- hose clamp pliers
- flat blade screwdriver

Step 1 – Remove the front bezel.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
4. Locate the front bezel.
5. Remove the nut and washer from each of the top Phillips screws which secure the front bezel and the display board grounding cables.
6. Remove two tubes marked P5 and P6 where they connect to the argon control valve.
7. Disconnect the 40-pin ribbon cable at J8 and the 5-pin ESU cable at J7 from the control board.
8. Remove the 4 Phillips screws securing the front bezel to the chassis.
9. Disconnect the 4 power wires from the unit power switch.

Step 2 – Remove the Display Board.

1. Disconnect the 8-pin keyboard cable.
2. Remove the shaft retainers from the flow control knob and overpressure setpoint knob.
3. Remove the 6 slotted screws and spacers that secure the Display Board.
4. Remove the Display Board.

Step 3 – Replace the Display Board.

1. Position the Display Board over the 2 knob shafts and onto 2 plastic locator pins on the back side of the front bezel. Ensure the 6 holes in the Display Board align with the 6 threaded inserts embedded into the front bezel.
2. Insert the 6 slotted screws through spacers. The angled surface of the spacer should be toward the distal end of the screw. Insert the slotted screws through the Display Board into the threaded inserts of the front bezel. Tighten the screws.
3. Install shaft retainers onto the flow control knob and overpressure setpoint knob.
4. Connect the 8-pin keyboard cable to the Display Board.

Step 4 – Replace the front bezel.

1. Connect the 4 power wires from the chassis onto the unit power switch.
2. Position the front bezel on the chassis. Tighten the 2 longer Phillips screws into the top mounting holes and the 2 shorter Phillips screws into the bottom mounting holes to secure the bezel to the chassis.
3. Position the 2 Display Board grounding cables onto the top mounting screws. Secure each with lock washer and nut and tighten.
4. Connect the 40-pin ribbon cable to J8 on the Control Board and connect the ESU cable to J7.
5. Connect the tube marked P5 to the argon control valve exit and install the hose clamp. Connect the tube marked P6 to the upper port of the 3-way valve of the argon control valve and secure with a wire tie.
6. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.
7. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Power Switch Replacement

Equipment required:

- Phillips screwdriver
- flat blade screwdriver

Step 1 – Remove the unit power switch.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
4. Disconnect the 4 power wires from the power switch.
5. Use a flat blade screwdriver to compress the notched grippers of the switch while pushing the switch out the front side of the bezel.

Step 2 – Replace the unit power switch.

1. Position the new switch at the front of the bezel with the (|) in the upward position and the (O) in the lower position.
2. From the front of the bezel, push the switch through the bezel opening until the notched grippers are fully seated.
3. Connect the four power wires from the chassis to the power switch.

4. Place the top cover onto the chassis. Tighten the four Phillips screws that secure the cover to the chassis.
5. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Power Supply Board Replacement

Equipment required:

- Phillips screwdriver

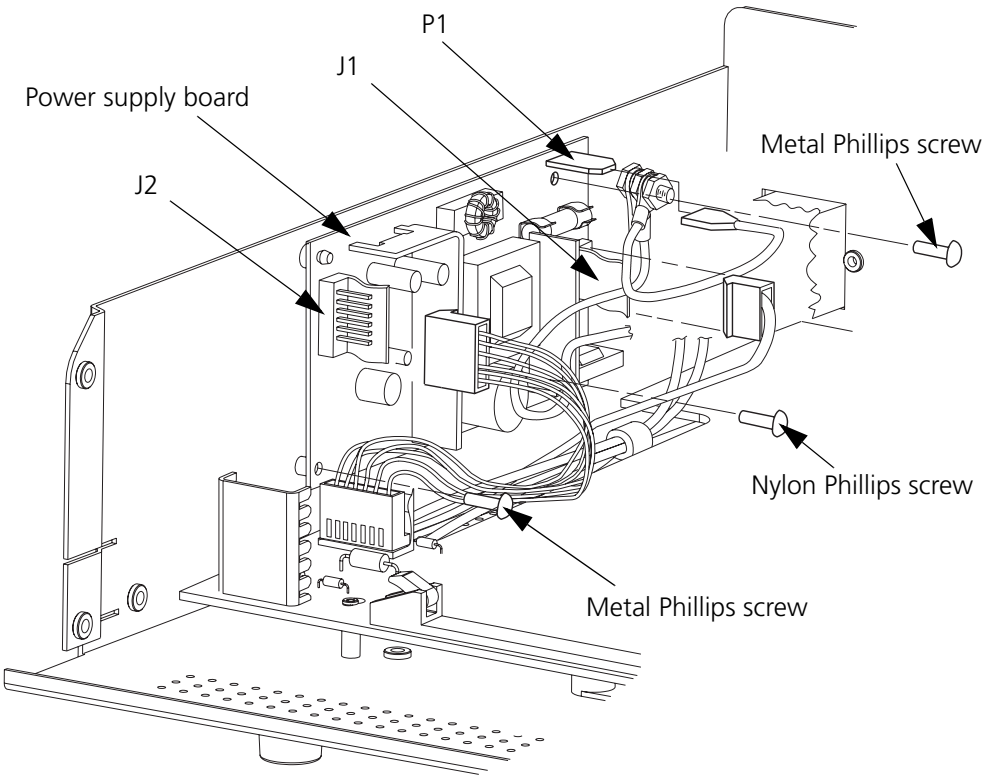
Step 1 – Remove the Power Supply Board.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
4. Locate the Power Supply Board.
5. Disconnect the following cables from the Power Supply Board.
   - 6-pin connector at J2
   - 3-pin connector at J1
   - ground cable at P1
6. Remove 1 nylon and 2 metal Phillips screws from three corners of the Power Supply Board. While compressing the standoff in the upper left hand corner, push the Power Supply Board away from the standoff.
7. Remove the Power Supply Board.

Step 2 – Replace the Power Supply Board.

1. Position the new Power Supply Board so that the 6-pin connection J2 is forward facing. Snap the upper left hand mounting hole of the Power Supply Board over the standoff.
2. Install 1 nylon and 2 metal Phillips screws through the remaining three holes with the nylon screw placed in the lower right hand corner. Tighten the screws (do not over tighten the nylon screw).
3. Connect the ground cable to P1 on the Power Supply Board.
4. Connect the 3-pin connector (unit power switch to Power Supply cable) to J1 on the Power Supply Board.
5. Connect the 6-pin connector (Power Supply Board to Control Board cable) to J2 on the Power Supply Board.
6. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.
7. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Replacing the Power Supply Board



Footswitch Board Replacement

Equipment required:

- Phillips screwdriver

Step 1 – Remove the Footswitch Board.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
4. Ensure that the footswitch and ESU interface cables are disconnected from the rear panel of the Valleylab Argon Gas Delivery Unit II.
5. Disconnect the 6-wire footswitch cable at J2 from the Control Board.
6. Disconnect the 3-wire ESU cable at J1 from the Footswitch Board.
7. Remove the 2 nylon and 2 metal Phillips screws that secure the Control Board to the chassis. Slide the Control Board off the keyhole standoffs and move it forward approximately 2.5 centimeters (toward the front bezel). You do not have to remove the Control Board from the chassis.
8. Remove the 4 Phillips screws that secure the Footswitch Board to the chassis. While compressing the Footswitch Board standoffs one at a time, gently push the board off the standoffs.
9. Remove the Footswitch Board. Disconnect the 6-wire footswitch cable from J3 on the Footswitch Board.

Step 2 – Replace the Footswitch Board.

1. Connect the 6-wire footswitch cable to J3 on the Footswitch Board.
2. Press the Footswitch Board onto the two standoffs on the rear panel of the chassis. Tighten the 4 Phillips screws that secure the Footswitch Board to the chassis.
3. Reposition the Control Board onto the keyhole standoffs and slide it toward the rear of the unit to lock in place. Tighten the 2 nylon and 2 metal Phillips screws that secure the Control Board to the chassis. One metal screw is used near TP5 and one near TP21 of the board. The 2 nylon screws are used near Q1 and C105. Do not over tighten the 2 nylon screws.
4. Connect the 6-wire footswitch cable to J2 on the Control Board.
5. Connect the 3-wire ESU cable to J1 on the Footswitch Board.
6. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.
7. Complete the initialization sequence described in Chapter 5, *Setup, Tests, and Adjustments*.

AC Inline Filter Replacement

Equipment required:

- Phillips screwdriver

Step 1 – Remove the AC inline filter.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
4. Locate the AC inline filter. Remove the load, neutral, and ground wires from the filter.
5. Remove the 2 Phillips screws securing the AC inline filter.

Step 2 – Replace the AC inline filter.

1. Position the new AC inline filter so that the load and neutral terminals are on top. Insert the filter through the chassis and tighten the 2 Phillips screws that secure the filter.
2. Connect the load, neutral, and ground cables.
3. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.
4. Complete the initialization sequence described in Chapter 5, *Setup, Tests, and Adjustments*.

Internal Argon Filter Replacement

Covidien recommends replacing the internal argon filter every six months.

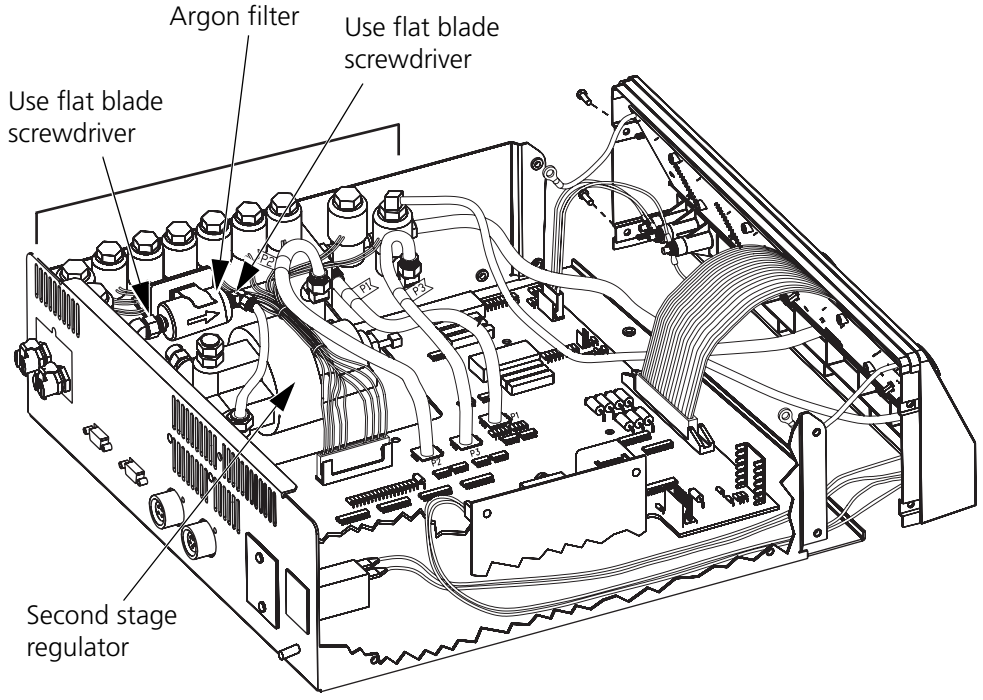
Equipment Required

- flat blade screwdriver

Step 1 – Remove the internal argon filter.

1. Turn off both gas tanks.
2. Purge both gas lines.
3. Press the unit power switch to the off position.
4. Unplug the unit power cord from the wall receptacle.
5. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
6. Locate the internal argon filter, and note the proper flow orientation.
7. Using the flat blade screwdriver, press the plastic release collar on the union elbow that connects the gas tube to the filter. At the same time, push the union toward the filter. While the release collar is pressed, pull the union elbow off the filter.
8. Repeat step 7 to release the filter from the elbow and remove the filter by sliding the filter through the clip. Discard the used filter.

Flow orientation of the internal argon filter



Step 2 – Replace the internal argon filter.

1. Insert the new filter into the elbow. Verify that the filter orientation is correct. Ensure the filter seats fully in the elbow.
2. Connect the tube union elbow. Ensure that the filter bottoms in the union elbow.

Step 3 – Check the filter and gas tube connections for leaks.

1. Connect the handset to the unit.
2. Plug the unit power cord into a hospital grade grounded receptacle.
3. Open the gas tank valves.
4. Press the unit power switch to the on position.
5. Verify that there are no leaks at the filter connections or at the gas tubing connections.
6. Press the unit power switch to the off position. Unplug the unit power cord from the wall receptacle.
7. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.
8. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Argon Control Valve Assembly/Second Stage Regulator Replacement

Equipment required:

- Phillips screwdriver
- vise
- wrench
- thread sealing tape

Step 1 – Purge the argon gas line(s).

1. Initialize the Valleylab Argon Gas Delivery Unit II.
2. Set the unit to standard gas flow and the argon gas to on. Set the flow rate to 8 LPM.
3. Turn off each argon supply tank.
4. Activate the handset or footswitch until the unit starts a Tank 1/Tank 2 search mode.
5. Turn the power switch to the off position.
6. Disconnect both argon supply tanks from the rear of the unit.

Step 2 – Remove the argon control valve assembly.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.
4. At the argon control valve assembly, remove tubing marked P1, P2, P3, P5, and P6. A small amount of argon will escape when the P1 tube is removed.
5. Disconnect the 20-pin connector at J4 from the Control Board.
6. Remove the 2 nuts, flat washers, and lock washers that secure the second stage regulator bracket to the chassis. Loosen, but do not remove, the 2 Phillips screws that secure the bracket to the second stage regulator.
7. Remove the three 70 mm and one 8 mm Phillips screws that secure the argon control valve assembly to the chassis.
8. Lift the regulator bracket off the 2 threaded studs at the bottom of the chassis and move the assembly forward until it meets the Control Board. Tilt up the rear of the assembly until the argon quick connectors clear the rear panel. Lift the assembly out of the chassis.

Step 3 – Remove the second stage regulator.

1. Remove the argon filter and tubing marked P4.
2. Secure the argon control valve assembly in a vise. Do not over tighten the vise.
3. Turn the street tee counterclockwise 45°. Remove the 90° elbow tube fitting. Remove the street tee.
4. With a wrench, hold the pipe nipple connecting the regulator and the argon control valve. Place the wrench on flats of the regulator and rotate counterclockwise. Remove the regulator.
5. Remove the 2 Phillips screws and lock washers securing the bracket to the regulator.

Step 4 – Replace the second stage regulator.

1. Remove thread sealing tape and clean all thread joints that were disconnected. Apply new thread sealing tape to the threads.
2. Secure the argon control valve assembly in the vise. Do not over tighten the vise.
3. Hand tighten the regulator onto the nipple. With the wrench, hold the pipe nipple connecting the regulator and argon control valve. Place wrench on flats of the regulator and rotate clockwise a minimum of one complete turn. Align the regulator to correct the orientation.

4. Hand tighten the street tee into the argon control valve. With the wrench, turn the street tee a minimum of one complete turn stopping 45° from the final orientation. Hand tighten the 90° elbow tube fitting into the street tee. With the wrench, turn the 90° elbow a minimum of one complete turn to its proper orientation. Tighten the street tee to its proper orientation.
5. Install the argon filter and tubing marked P4.

Step 5 – Replace the argon control valve assembly.

1. Place the argon control valve assembly into the chassis. Allow the assembly to rest on the three spacers. Ensure the assembly fits into the rear panel opening and is setting on all three spacers.
2. Place the regulator bracket over the threaded studs in the chassis. Secure the bracket to the regulator using 2 Phillips screws and lock washers. Do not tighten at this time.
3. Secure the argon control valve assembly with the three 70 mm Phillips screws, lock washers, and flat washers. Do not tighten. Tighten the 8 mm Phillips screw and flat washer that secure the argon control valve assembly to the rear panel of the unit. Tighten the three 70 mm Phillips screws.
4. Tighten the 2 flat washers, lock washers, and nuts that secure the regulator bracket to the chassis. Tighten the 2 Phillips screws securing the bracket to the regulator.
5. Connect the 20-pin connector to J4 on the Control Board.
6. Connect tubing marked P1, P2, P3, P5, and P6 to their respective connections on the argon control valve assembly.
7. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.
8. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Control Board Replacement

Equipment required:

- Phillips screwdriver

Step 1 – Remove the Control Board.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Remove the 4 Phillips screws securing the top cover to the unit. Remove the top cover.

4. Disconnect the following cables from the Control Board:
   - 40-pin ribbon cable at J8.
   - 6-pin power supply cable at J5.
   - 6-pin footswitch cable at J2.
   - 20-pin argon control valve cable at J4.
   - 5-pin ESU cable at J7.
   - 8-pin transducer cable at J3.
5. Disconnect the 3-pin ESU cable at J1 from the Footswitch Board.
6. Disconnect tubing marked P1, P2, and P3 at the argon control valve assembly. A small amount of argon will escape when P1 tube is removed. Remove the tubing marked P6 from the two wire standoffs.
7. Remove 2 nylon and 2 metal Phillips screws that secure the Control Board to the chassis. Slide the Control Board off the keyhole standoffs and move it forward approximately 2.5 centimeters (toward the front bezel). Lift the Control Board up, past the Power Supply Board, and out of the chassis.

Step 2 - Replace the Control Board.

1. Place the Control Board over the chassis. Lower the right side of the board (near Q1) and slide it under the argon control valve assembly. Lower the opposite side of the board past the Power Supply Board and position the Control Board over the standoffs.
2. Reposition the Control Board onto the keyhole standoffs and slide it toward the rear of the unit to lock in place. Tighten the 2 nylon and 2 metal Phillips screws that secure the Control Board to the chassis. One metal screw is used near TP5 and one near TP21 of the board. The 2 nylon screws are used near Q1 and C105. Do not over tighten the 2 nylon screws.
3. Connect the following cables to the Control Board:
   - 40-pin ribbon cable at J8.
   - 6-pin power supply cable at J5.
   - 6-pin footswitch cable at J2.
   - 20-pin argon control valve cable at J4.
   - 5-pin ESU cable at J7.
   - 8-pin transducer cable at J3.
4. Connect the 3-pin ESU cable at J1 on the Footswitch Board.
5. Connect tubing marked P1, P2, and P3 to the argon control valve assembly. Install the tubing marked P6 into the two wire standoffs at the front of the Control Board.
6. Place the top cover onto the chassis. Tighten the 4 Phillips screws that secure the cover to the chassis.

7. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Fuse Replacement

Equipment required:

- flat blade screwdriver

Step 1 – Remove the fuses.

1. Verify that the unit power switch is in the off position.
2. Unplug the unit power cord from the wall receptacle.
3. Locate the AC inline filter on the unit rear panel. The fuse drawer is located in the upper portion of the AC inline filter.
4. Using the flat blade screwdriver, snap the fuse drawer out at the lower edge. Remove the fuse drawer to expose the two fuses. Remove and discard both fuses.

Step 2 – Replace the fuses.

Warning

For continued protection against fire hazard, replace fuses only with those having the same type and rating as the original fuse.

1. Install two new fuses into the fuse drawer.
2. Slide the fuse drawer into the AC inline filter and snap the drawer shut.
3. Complete the initialization sequence described in Chapter 5, "Setup, Tests, and Adjustments."

Argon Gas Tank Replacement

Warning

Use only high purity grade (99.998% pure, or better) argon gas. Patient safety may be compromised by using low purity gas.

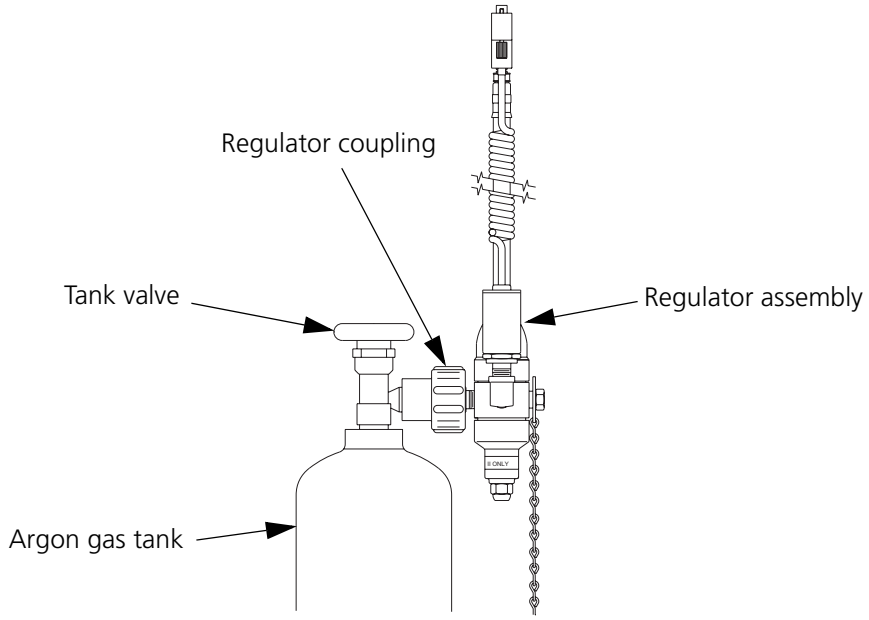
High Pressure Hazard: Ensure that argon gas tanks and fittings used with the Valleylab Argon Gas Delivery Unit II System have been pressure tested, certified, and filled according to applicable standards and local codes. **Do not** over pressurize the tanks.

The regulator coupling in this unit is compatible with many common gas tanks (e.g., Freon, helium, krypton, neon, nitrogen, and xenon). **Only connect argon gas to the Valleylab Argon Gas Delivery Unit II System.** Using other gases may affect gas flow, create phosgene or other harmful gases, or create an explosion hazard.

Step 1 – Remove the gas tank.

1. Follow the appropriate safety precautions for handling high pressure gas tanks. If applicable, obtain the tank safety cap before proceeding.
2. Make sure the Force Argon™ II unit is off, the electrosurgical generator is off or in standby, and the valves on both argon gas tanks are completely closed.
3. It is normal for a small amount of argon to escape during this procedure. To disconnect the tank from the high pressure regulator assembly, hold the regulator assembly stationary while you loosen the regulator coupling. If applicable, attach the safety cap to the top of the tank.
4. Loosen or remove the restraining straps from the tank. Carefully lift the tank from the holder. Tank weights range from 10-35 lb. (5-16 kg).

Replacing the argon gas tank



Step 2 – Replace the gas tank.

1. Carefully place the replacement tank into the tank holder. Secure the restraining straps.
2. If applicable, remove the gas tank safety cap and store it safely. You will need the safety cap when you refill the gas tanks. Do not remove the gas tank identification tag(s).

Warning

Use only the high pressure regulator supplied with the Valleylab Argon Gas Delivery Unit II. Replacement regulators should be ordered from Covidien. Argon gas pressure should not exceed 434 KPa (63 psig) ± 5% at the regulator hose connection to the receptacle on the rear panel.

1. If using the high pressure regulator for the first time, install the appropriate regulator to tank fitting into the regulator. Refer to the *Regulator to Tank Connection Fitting Installation Instructions* packaged with the high-pressure regulator.
2. Verify that the correct hose is connected to the correct tank. (Regulator assembly #1 with orange hose band to tank 1, and regulator assembly #2 with blue hose band to tank 2.)
3. Verify that the Tank 1 transducer cable is connected to the Tank 1 transducer receptacle on the Valleylab Argon Gas Delivery Unit II rear panel. Verify that the Tank 2 transducer cable is connected to the Tank 2 transducer receptacle on the Valleylab Argon Gas Delivery Unit II rear panel. Align the regulator coupling to the tank valve outlet. Connect the coupling to the outlet and tighten.

Caution

Improperly secured gas tanks and/or improper connection of high pressure gas lines may result in injury.

Step 3 – Check for leaks.

1. Connect the handset to the system.
2. Open the gas supply valve.
3. Press the unit power switch to the on position.
4. Using the handset or gas controls, turn the gas on.
5. Activate the handset. While gas flows to the handset, pinch off the gas line to obstruct gas flow. Verify the following:
   - The **Obstruction** indicator illuminates.
   - The **Gas Flow** indicator flashes.
   - An alarm sounds for approximately three seconds.
6. Release the pinched gas line.

Chapter 8

Repair Policy and Procedures

This chapter describes the responsibilities assumed by Covidien for the performance of the Valleylab Argon Gas Delivery Unit II. Refer to this chapter for the procedures to follow when returning circuit boards or the unit to Covidien for service.

Responsibility of the Manufacturer

Covidien is responsible for the safety, reliability, and performance of the Valleylab Argon Gas Delivery Unit II only under the following circumstances:

- Installation and setup procedures in this manual are followed.
- Assembly operations, readjustments, modifications, or repairs are carried out by persons authorized by Covidien.
- The electrical installation of the relevant room complies with local codes and regulatory requirements, such as the IEC and BSI.
- The equipment is used in accordance with the instructions for use.

For details regarding the warranty, refer to the Warranty at the beginning of this manual.

Obtaining a Return Authorization Number

Before you return the unit to Covidien, call Covidien (1-800-255-8522 or 1-303-530-2300) to obtain a Return Authorization Number, or call your Covidien representative for assistance.

Have the following information ready when you call:

- hospital/clinic name/customer number
- telephone number
- department/address, city, state, and zip code
- model number
- serial number
- description of problem
- type of repair to be done

Do not return gas tanks to Covidien.

Returning Circuit Boards and Other Subassemblies

Package circuit boards or other subassemblies for shipment as follows:

1. Place each circuit board or subassembly in an Electrostatic Discharge (ESD) bag or container.
2. Provide a separate packing container for each circuit board or subassembly.
3. When returning pressure regulators, use at least four inches of tightly packed industry approved shock absorbing packing material on all sides including the bottom.
4. Attach a tag to the container that includes the Return Authorization Number and the information (hospital, phone number, etc.) listed above in Obtaining a Return Authorization Number.
5. Ship the circuit board or subassembly prepaid to a Covidien Service Center.

Returning the Valleylab Argon Gas Delivery Unit II for Service

If you are returning the Valleylab Argon Gas Delivery Unit II for service, clean the unit before shipping it to Covidien.

Cleaning the Unit

Use a mild cleaning solution or disinfectant and a damp cloth to clean the unit surfaces and power cord. Do not allow fluids to enter the chassis. The unit cannot be sterilized.

1. Turn off the unit by pressing the power switch.
2. If applicable, disconnect the electrosurgical generator and all accessories from the unit.

Warning

Electric Shock Hazard Always unplug the unit before cleaning.

3. Unplug the unit power cord from the wall receptacle.

Caution

Do not clean the unit with abrasive cleaning or disinfectant compounds, solvents, or other materials that could scratch the surfaces or otherwise damage the unit.

4. Thoroughly wipe all surfaces with a cleaning solution or disinfectant. Follow the procedures approved by your institution or use a validated infection procedure.

Shipping the Unit

1. Remove and retain the footswitch.
2. Attach a tag to the unit that includes the Return Authorization Number and the information (hospital, phone number, etc.) listed earlier in Obtaining a Return Authorization Number.
3. Place the interface cable in the packaging container with the unit.
4. Be sure the unit is completely dry before you pack it for shipment. Place the unit in a plastic bag.
5. Package the unit in its original shipping container or use a packing container with double wall construction.
6. Ship the unit prepaid to a Covidien Service Center.

Disposing of the Valleylab Argon Gas Delivery Unit II

If necessary, dispose of the Valleylab Argon Gas Delivery Unit II according to national requirements for medical devices.

Service Center

Covidien
Boulder, Colorado, 80301-3299
USA
Ph: 303-530-2300
Toll Free: 800-255-8522

Chapter 9

Service Parts

Replacement parts for the Valleylab Argon Gas Delivery Unit II are listed in this chapter. If the part number is not listed for a specific item, a replacement for that item is not available.

All components must be replaced with parts of identical construction and value. Replacement ratings and tolerances must be equal to or better than the original.

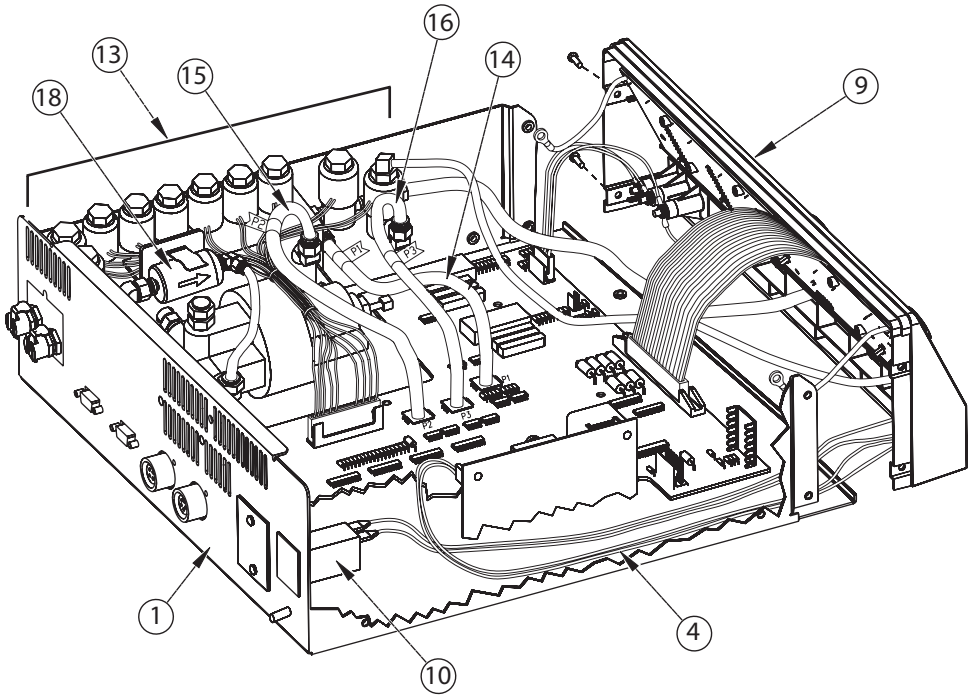
Ordering Replacement Parts

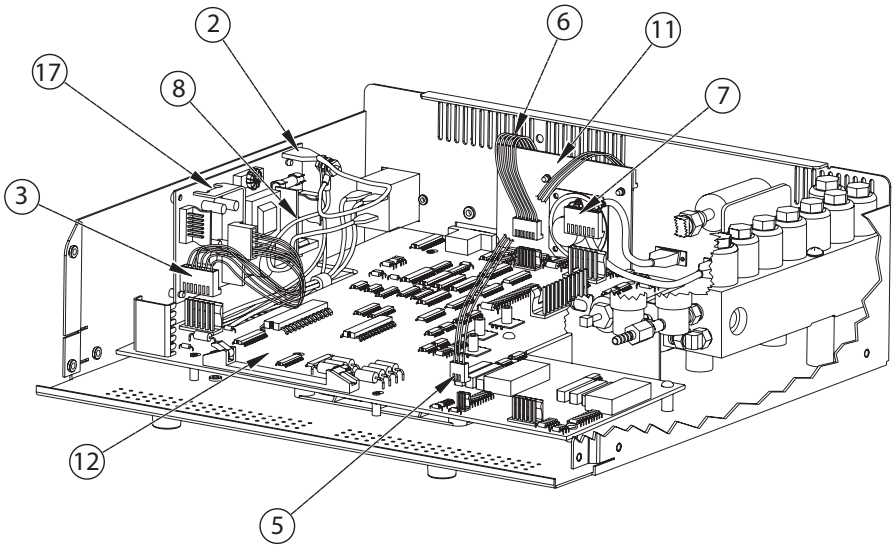
Parts may be ordered from Covidien Technical Service (1-800-255-8522 or 1-303-530-2300). Additional contact information for Technical Services can be found at www.valleylab.com.

When ordering replacement parts, include this information:

- model number (located on the rear panel of the unit)
- serial number (located on the rear panel of the unit)
- part number (for the part you are ordering)
- modification number, if applicable

Valleylab Argon Gas Delivery Unit II Assembly





Argon Gas Delivery Unit II Parts List

Item	Description	Part Number
1	Base	223 200 715
	Includes:	
	Rubber Foot (4)	213 400 082
	Screw, pan hd, M4 x 10 mm (4)	237 050 139
	Handle Assy.	223 300 054
	Screw, pan hd, M4 x 6 mm, blk. (4)	237 050 137
	Screw, slot, bnd hd., 4-40 x 1/8 (4)	237 015 091
	Screw, pan hd, M3 x 10 mm (6)	237 050 138
	Standoff, power supply, nylon	213 110 596
	Standoff, wire, nylon (5)	213 110 610
	Screw, phil pan hd, M4 x 0.7 x 8 (11)	237 050 113
	Cover, serial port	223 200 591
	Washer, lock, intl metric M4 (13)	253 300 045
	Screw, phil, flat hd, M3 x 0.5 x 10 (2)	237 050 125
	Screw, pan hd, M4 x 0.7 x 70 mm (3)	237 050 155
	Washer, metric, M4 (6)	253 300 005
	Spacer, regulator (3)	213 110 595
	Standoff, insulated, main bd. (2)	213 110 605
	Screw, 3.5 mm, .6 mm pitch, 6 mm lg	237 050 157
	Screw, pnh phh, M4 x 0.7 x 12 mm (2)	237 050 171
	Nut, hex, M4 x .7, stl zinc pld (7)	224 300 033

Item	Description	Part Number
	Screw, pan hd, phil, M4 x 0.7 x 8, nylon (2)	237 050 143
2	Assembly, Cable, Power Supply to Chassis Ground	202 450 095
3	Assembly, Cable, Power Supply to Main Board	202 450 001
4	Assembly, Cable, Power Switch to Power Supply	202 450 002
5	Assembly, Cable, Main Board to Footswitch Board - Footswitch	207 500 910
6	Assembly, Cable, Main Board to Footswitch Board	207 500 580
7	Assembly, Cable, Main Board to Tank Transducers	202 750 267
8	Assembly, Cable, Power, Ground, FA2	202 450 000
9	Assembly, Front Panel	202 701 913
	Includes:	
	Assy., Display Board See *Display Board Components* in this chapter.	201 357 000
	Fitting, Bulkhead, 1/8-3/16 ID	243 500 075
	Display Board Mount Spacers (6)	213 110 594
	Screw, Panhd (6)	237 050 017
	Fitting, Bulkhead to 1/16 Tube	243 500 236
	Washer, 1/4" (2)	253 010 033
	Bezel/Overlay Assy.	202 701 935
	Hose Spring Clamp	213 150 089
	Tubing Array Exit Assy.	202 450 013
	Tubing Overpressure Assy.	202 450 014
	Sealant, Fastener	232 301 039
	Shaft Knob Assy. (2)	223 320 081

Item	Description	Part Number
	Clip Shaft (2)	213 130 038
	RTV Clear Sealant	226 008 001
10	Assembly, Line Filter	202 701 936
	Includes:	
	Assy., Cable, Line Filter to Power Switch	202 400 998
	Fuse, 1 A Slow Blow, 5 x 20 mm (2)	215 100 077
	EMI Filter	251 400 007
11	Assembly, Footswitch Board See *Footswitch Board Components* in this chapter.	201 358 000
12	Assembly, Control Board See *Control Board Components* in this chapter.	201 359 005
13	Assembly, Valve Solenoid	202 750 076
14	Assembly, Tubing Transducer, ¼ " ODP1	202 450 009
15	Assembly, Tubing Transducer, ¼ " ODP2	202 450 010
16	Assembly, Tubing Transducer, ¼ " ODP3	202 450 011
17	Power Supply	207 000 151
18	Argon Filter	243 500 073
Not Shown		
	Cover, Upper	223 200 603
	Tag, Receptacle Notice	216 151 414
	Power cord, right angle, molded, 220 V	207 002 061

Footswitch Board Components

Reference Designator	Description	Part Number
Capacitors		
C1, C2, C3	.01 µF ± 20%, 50 V	204 200 456
C4, C5, C6	470 pF ± 5%, 100 V	204 200 481
Resistors		
R1, R2	5.6 Ω ± 5%, .25 W	234 024 009
R3, R4	0 Ω Jumper	234 300 080
Diode		
CR1, CR2	1N4148	239 014 000
Miscellaneous		
Item 2	Speaker, miniature #707	241 003 000
Item 3	Screw, metric M3 x 8 mm lg (4)	237 050 149
Item 4	Nut, hex M3 x 0.5 stl zinc pld (4)	224 300 004
Item 5	Wire, Teflon 24 awg white	255 120 140
Item 6	Bracket, footswitch connector	223 301 149
FB1-FB8	Ferrite Bead	251 100 126
J1	Connector, RT (3 pin)	208 300 753
J3	Connector, RT (6 pin)	208 300 752

Reference Designator	Description	Part Number
J4	Connector, 4 wire, chassis	208 071 000
J5	Connector, Circ. Socket (5 pin)	208 300 689
K1-K4	Relay, Dip Reed SPSTNO 12V (4)	230 010 000

Display Board Components

Reference Designator	Description	Part Number
Capacitors		
C1, C5, C7, C8	.1 µF ± 20%, 50 V	204 200 460
C2, C6	10 µF ± 20%, 25 V	204 600 067
C3, C4	47 µF ± 20%, 20 V	204 600 076
Resistors		
R1, R2, R10, R11	240 Ω ± 5%, .25 W	234 024 048
R3-R9	68 Ω ± 5%, .25 W	234 024 035
RA1	Network 13 X 1.0 kΩ	234 150 005
RA2	Network 7 X 2.2 kΩ	234 150 006
RA3	Network 13 x 4.7 kΩ	234 150 007
Integrated Circuits		
U3	74HC541	210 230 016
U4	2803A	210 800 002
U5, U7	7218A (2)	210 800 025

Reference Designator	Description	Part Number
U6	74LS374	210 520 374
LEDs		
D2, D10	Green .2 dia (2)	239 750 063
D8, D9, D13, D14	Red, 7 segment, large (4)	239 750 051
D16, D17	Red, .2 dia (2)	239 750 083
U1, U2	Red, 7 segment, small (2)	239 750 028
Miscellaneous		
Item 2	Display Cable Assy., Bd. to Ch. (2)	202 450 008
D1, D3, D4, D5, D6, D7, D15	Lamp, 12 V, incandescent	215 200 085
D11, D12	Display, Bar Graph	239 750 079
D8S, D9S, D13S, D14S	Socket, 14.2 mm, 7 seg. display	208 500 094
J1	Ribbon Cable Assy., M. Bd. to P.	207 500 556
J2	Connector, 8 pin	208 300 754
S1, S2	Switch, quad, encode	243 025 027
U8, U9	Transistor, Array	239 200 057
U1S, U2S	Socket, 10 mm, 7 seg. display	208 500 095

Control Board Components

Reference Designator	Description	Part Number
Capacitors		
C1-C6, C8, C21, C23, C24, C28, C30, C31, C34-C36, C38, C39, C41-C49, C52-C55, C57, C59, C61, C63, C64, C70, C72, C74, C75, C76, C78-C82, C85-C88, C90, C91, C93, C95, C96, C98, C99, C100-C112, C121, C122, C123, C124	.1 µF ± 20%, 50V	204 200 460
C7, C115-C120	5600 pF ± 10%, 50 V, X7R	204 200 574
C9, C10, C12, C13, C40, C60, C66, C67	.01 µF ± 20%, 50 V	204 200 456
C11, C16, C19, C22, C25, C27, C29, C71, C84, C89	10 µF ± 20%, 25 V, tant	204 600 067
C14	1 µF ± 10%, 35 V, tant	204 600 066
C15, C26	2.2 µF ± 10%, 50 V	204 200 587
C17, C20	1.0 µF ± 10%, 50 V	204 200 576
C18, C56, C83, C92, C94	4.7 µF ± 10%, 20 V, tant	204 600 079
C32, C33	22 pF ± 5%, 100 V	204 200 450
C37, C58, C97	47 µF ±20%, 20 V, tant	204 600 076
C50, C51	27 pF ± 5%, 100 V, COG	204 200 469
C62, C65, C77	.22 µF ± 10%, 50V	204 200 461
C68	1000 pF ± 5%, 100 V, COG	204 200 485
C69, C73	470 pF ± 5%, 100 V, COG	204 200 481
C113, C114	1000 pF ± 10%, 50 V	204 200 485

Reference Designator	Description	Part Number
Connectors		
J1	PCB, 9 pin, 90 degree	208 300 871
J2	PCB, 6 ckt, .100" ctrs	208 200 321
J3	PCB, 8 ckt	208 160 058
J4	PCB, 20 ckt, .1 ctrs	208 200 320
J5	PCB, 6 ckt	208 160 056
J6	PCB, 3 ckt, .1 cnts	208 200 324
J7	PCB, 5 ckt	208 160 055
J8	PCB, 40 ckt, dual row	208 200 323
JP1-JP3	PC Male, 3 pin	208 188 003
Resistors		
R1, R3, R20, R24	48.7 kΩ ± 1%, .125 W	234 204 047
R2, R31	200 Ω ± 1%, .125 W	234 201 222
R4, R6, R8, R10, R13, R17, R19, R21, R23, R30, R32, R34, R37, R86, R92, R95, R98, R101, R104, R108, R114, R124	20 kΩ ± 1%, .125 W	234 201 414
R5, R9, R25, R27	4.99 kΩ ± 1%, .125 W	234 201 356
R7, R33	23.2 kΩ ± 1%, .125 W	234 204 042
R11, R12, R15, R16	49.9 kΩ ± 1%, .125 W	234 201 452
R14, R36	150 kΩ ± 1%, .125 W	234 204 036
R18, R22	3.48 kΩ ± 1%, .125 W	234 201 341

Reference Designator	Description	Part Number
R26, R35, R38, R46, R96, R105, R107, R109, R122, R125	51.1 kΩ ± 1%, .125 W	234 201 453
R28	7.68 kΩ ± 1%, .125 W	234 204 070
R29, R121, R128, R132, R133, R178, R179, R180	10 kΩ ± 1%, .125 W	234 201 385
R39, R41	100 Ω ± 1%, .125 W	234 201 193
R40, R45	19.6 kΩ ± 1%, .125 W	234 201 413
R42, R47	1.78 kΩ ± 1%, .125 W	234 204 050
R43, R44	18.2 kΩ ± 1%, .125 W	234 201 410
R48, R49, R88, R115, R118, R123, R163	10 kΩ ± 5%, .25 W	234 024 087
R50, R53, R54, R57, R59, R61, R62, R64, R65, R67, R68, R70, R71, R73, R74, R76, R77, R79, R81, R83	2.2 Ω ± 1%, .25 W	234 204 041
R51, R55, R60, R63, R66, R69, R72, R75, R78, R82	30 Ω ± 5%, 3W	234 204 043
R52	820 Ω ± 5%, .25 W	234 024 061
R56	2.2 kΩ ± 5%, .25 W	234 024 071
R58, R80, R87, R141	4.7 kΩ ± 5%, .25 W	234 024 079
R84, R91, R106, R113	162 kΩ ± 1%, .125 W	234 204 038
R85	20 kΩ ± 5%, .25 W	234 024 094
R89, R99, R110	4.12 kΩ ± 1%, .125 W	234 201 348
R90	2.7 kΩ ± 5%, .25 W	234 024 073
R93, R102 R116	182 kΩ ± 1%, .125 W	234 204 039
R94, R103, R120	22.6 kΩ ± 1%, .125 W	234 201 419

Reference Designator	Description	Part Number
R97, R100	165 kΩ ± 1%, .125 W	234 204 037
R111	7.15 kΩ ± 1%, .125 W	234 201 371
R112, R139	0 Ω Jumper	234 300 080
R117	6.34 kΩ ± 1%, .125 W	234 204 069
R119, R126, R181, R182, R183	1 kΩ ± 5%, .25 W	234 024 063
R127	11 kΩ ± 1%, .125 W	234 201 389
R129	10 Ω ± 5%, .25 W	234 024 015
R130, R134, R140	3.3 MΩ ± 5%, .25 W	234 024 146
R131	2.49 kΩ ± 1%, .125 W	234 201 327
R135	137 kΩ ± 1%, .125 W	234 204 071
R136	499 Ω ± 1%, .125 W	234 201 260
R137	115 kΩ ± 1%, .125 W	234 201 487
R138	2.74 kΩ ± 1%, .125 W	234 201 331
R142	15 Ω ±1%, 3 W	234 400 252
R143, R146, R153, R154, R159	4.3 Ω ± 1%, 1W	234 400 280
R144, R176	750 Ω ± 1%, .125 W	234 201 277
R145, R160	2.7 Ω ± 1%, 1 W	234 400 279
R147, R167	5.1 kΩ ± 5%, .25 W	234 201 165
R148, R149, R151, R152, R174, R175	1 kΩ ± 1%, .125 W	234 201 289
R150	3.01 kΩ ± 1%, .25 W	234 201 335
R155, R156	2 kΩ ± 1%, .25 W	234 201 318

Reference Designator	Description	Part Number
R157, R158, R161, R162, R165, R166	1.5 kΩ ± 5%, .25 W	234 024 067
R164, R168	390 Ω ± 5%, .25 W	234 024 053
R169, R171, R172, R173, R177	1.5 kΩ ± 1%, .25 W	234 201 306
R170	2 kΩ ± 5%, .25 W	234 024 070
RA1	Network 13 x 4.7 k Ω	234 150 007
RA2	Network 10 k x 8	234 150 010
RA3	Network 13 x 10 k Ω	234 150 008
Transistors		
Q1, Q2	FET VN10KM	239 200 012
Q3	2N3904	239 015 100
Q4	FET P-CH 60 V, 12 A	239 200 015
Integrated Circuits		
U1, U2, U3, U6, U25, U26, U27, U30, U32, U35	LT1013CN8 OP AMP	210 410 005
U8, U31, U36,	TLC2272CP OP AMP	210 400 026
U4	MC34119P	210 100 039
U5	MC145407	210 600 004
U7, U11, U17, U24, U43	2803A	210 800 002
U9	LM 393 AN	210 410 004
U10, U14, U16, U23	74HC 273	210 100 040

Reference Designator	Description	Part Number
U12	Programmed PIC FA2	210 730 262
U13	74HC374	210 220 398
U15	74HC541	210 230 016
U18, U19	74HC86	210 220 399
U20	DS1232	210 760 015
U21	NM93C46N	210 720 025
U22, U52	74HC00	210 230 007
U28, U29	74HC138	210 230 003
U33	74HC373	210 230 001
U34	M7555 IPA	210 100 041
U37	MCM6264CP25	210 300 101
U38	Programmed Prom FA2	210 730 240
U39	MAX186CCPP	210 740 011
U40	80C31	210 710 016
U41, U50, U51, U53	LM339AN	210 300 015
U49	74HC245	210 220 396
U54	IC4070B	210 210 070
Diodes		
CR1-CR4, CR11, CR13	Shottky, 1N5817	239 700 005
CR5, CR9	1N4002	239 091 002
CR6-CR8, CR10, CR15, CR16	1N4148	239 014 000

Reference Designator	Description	Part Number
CR12, CR14	Zener, 47 V, 1N4756A	239 600 642
CR17, CR18	Zener, 10 V, 1N5240B	239 600 001
CR19	Zener, 8.2 V, 1N5237B	239 600 643
Miscellaneous		
FB1, FB2	Ferrite Bead	251 100 126
L1, L2	Inductor, 1.0 mH	251 100 127
L3-L5	RF Choke, 55 µH	251 100 098
PS1, PS2	Transducer, Pressure, PCB, 50 psi	203 500 020
PS3	Transducer, Pressure, PCB, 2 psi	203 500 019
T1, T2	Transformer, square core	251 300 045
TP1-TP21	Test Point	208 200 284
U12S, U38S	Socket, IC	208 500 087
U42, U44-U48	Opto-Isolator, single, pcb mount	239 750 073
Y1	Crystal, 3.579 MHz	250 010 039
Y2	Crystal, 11.059 MHz	250 010 038
Item 2	Heatsink, black anodized	223 400 656
Item 3	Assy, cbl, dspl, bd to chas	202 450 008
Item 4	Jumper	208 400 114
Item 5	Screw, panhd, M3 x 0.5 x 8	237 050 149

Reference Designator	Description	Part Number
Item 6	Washer, lock, internal, metric M3	253 300 044
Item 7	Nut, hex, M3 x 0.5, stl zinc pld	224 300 004
Item 8	Tbg, tef, non-shrk, 22AWG, LG	249 000 059